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WALKER (J. C.) & JONES (L. R.). **Relation of soil temperature and other factors to Onion smut infection.**—*Journ. Agric. Res.*, xxii, 5, pp. 235-262, 3 pl., 1921.

The cotyledon of the onion is susceptible to attack by *Urocystis cepulae* for a period of about three weeks from germination, after which it becomes resistant and infection fails. Onion seeds germinate and growth occurs at all soil temperatures from 10° to 31° C., the most rapid germination and best top growth taking place from 20° to 25° C., while as a rule the best root growth is got below 20° C.

Smut infection occurs freely at soil temperatures of from 10° to 25° C., but there is a decided diminution in infection at 27° and complete freedom from the disease at 29°. In these experiments the air temperature was kept uniformly at 15° to 20° C.

When plants bearing incipient infections were exposed to an air and soil temperature of 30° to 33° C. the progress of the infection was inhibited, even if it had extended to the stage when pustules were beginning to appear (ten or twelve days). The effect was permanent in so far that no further development of the fungus occurred when the plants were again returned to the lower temperature (15° to 20°) after twelve to fifteen days at the high one. On the other hand, a high air temperature alone, the soil temperature being kept at 20° to 25°, permitted free infection and subsequent development. These results suggested that the inhibitory effect of the high soil and air temperatures was due to some marked alteration in the metabolism of the host plant and not merely to a direct effect on the growth of the fungus in the heated aerial parts of the plant.

A comparison was made between the development of the disease in plants grown at 15° to 20° and at 24° to 28° C. of both air and soil. A high degree of cotyledon infection resulted in both cases, but at the higher temperature the plants tended to outgrow the disease and the cotyledons were lost before infection of the first true leaf occurred. In field experiments complete freedom from the disease was attained when the daily mean soil temperature at

one to two inches depth remained at or slightly above 29° C. for two or three weeks.

These results were correlated with the observed incidence of the disease in the United States. In the Southern States onions are grown, during the critical period of infection (August–September in Texas), at a mean air temperature above that at which the disease is inhibited, and it is probable that the temperature of the upper layer of the soil is higher by several degrees. In these regions the disease has not appeared, though there must have been many opportunities for its introduction. In the north, on the other hand, the temperature during the critical period for infection is relatively low and the disease is prevalent from New York to Oregon.

Soil moisture variations were found to have little effect, only inhibiting infection at very low or very high extremes, at which the germination and growth of the host is also retarded.

JONES (F. R.) & VAUGHAN (R. E.). **Anthracnose of the garden Pea.**—*Phytopath.*, xi, 12, pp. 500–503, 1 pl., 2 figs., 1921.

Anthracnose caused by *Colletotrichum pisi* Pat., which caused great damage to peas in some areas in Wisconsin in 1912 and 1920, differs little in general character from that due to the more common *Ascochyta pisi*. It occurs on all the aerial parts of the plant, and though it has not been detected on the seed itself, there is apparently no obstacle to the penetration of seeds in diseased pods. On leaves the lesions are irregular in shape, smoky grey or brown near the margin and lighter brown at the centre. On pods they are usually lighter in colour, more nearly circular, and dark brown at the margin, while on the stem they are elongated, occasionally extending all around the circumference, and after the spores develop are ashy when dry and copper-coloured when moist. Setae are sometimes produced in great abundance on stems. On nearly mature stems, rusty areas of considerable extent may occur where the spores are produced in tiny acervuli.

The importance of the disease in the United States is probably slight, owing to its limited distribution, but there is a possibility of destructive epidemics occurring under suitable conditions.

The host range of the fungus includes horticultural varieties of *Pisum sativum* L. and also *P. sativum umbellatum* (Mill.), *P. elatius* Bieb., and *P. jomardi* Schrank. It was not possible to infect varieties of bean and clover; the spores germinate abundantly on clover leaves, but in no case observed did the germ-tube penetrate the epidermal cell. In culture the surface usually becomes covered with black sclerotial bodies merging to form a crust, upon which only a few spores are found. Mature woody sweet clover or pea stems were the best substrata for the production of acervuli, which are golden yellow or salmon coloured. Setae are produced sparingly.

The conidia germinated readily on agar plates at temperatures from 10° to 30° C. in 18 hours. In 24 hours spores germinated at temperatures down to 7° C. At 21° C. spores germinated and produced appressoria on the leaf-surface in 26 hours. The appressoria are formed very close to the end of the spore. They are

irregularly rounded structures, reddish-brown in colour, and generally situated near the edge of an epidermal cell. After 36 hours at 21° C. the fungus had penetrated the epidermal cell directly below the appressorium and begun to produce a mycelium.

MATZ (J.). **Una enfermedad dañina de la Habichuela.** [A harmful disease of the Bean.]—*Est. Exper. Ins., Porto Rico, Circ.* 57, 8 pp., 1 pl., 1921.

The writer states that the disease of the bean (*Phaseolus* sp.) caused by *Rhizoctonia microsclerotia* is little known outside Porto Rico, the Philippines, and India. Since 1918 its occurrence has been under observation in some localities on the island, and it has broken out abruptly at each successive harvest, remaining in an inactive condition until the plants are mature. It can easily be recognized, as it causes the collapse of the leaves into a sticky mass, the dark and rotting appearance of the foliage being characteristic. When falling, these diseased leaves may adhere to other healthy parts of the plant, owing to the way they are stuck together by the fungus, and further infection takes place. The sclerotia, 0·5 mm or less in diameter, round, dark or sometimes white, and easily detachable, occur all over the stalk, petiole, and veins of the leaf, and on falling on the soil may remain viable there for months until favourable circumstances for germination arise; young plants, when not sown too densely, are not attacked, as the free admission of light and air to the surface of the soil inhibits germination of the sclerotia. The latter first germinate, as a rule, when the ground is densely covered by the crop and humid conditions prevail under and around the plants. The fungus then spreads to the lower leaves and rapidly passes along the stem to the upper parts of the plant. The stem itself is rarely directly damaged by the parasite as the tissues are too resistant, but the tender leaves and pods succumb easily.

The author recommends that beans should be sown so that they may ripen before the rainy season sets in; localities sheltered from all air-currents should be avoided; infected plants should be destroyed; and suitable crops (e.g. tobacco or maize) should be grown in rotation with beans, on infected soil. Burning dead stalks and other refuse on the ground is said to be a good practice, while spraying with Bordeaux (3–3–50) is effective in small plantations.

Hawthorn in relation to fireblight.—*New Zealand Journ. of Agric.*, xxii, 4, p. 255, 1921.

In view of the part played by hawthorn in the spread of fireblight in New Zealand [See this *Review*, i, 1, p. 22] the Noxious Weeds Amendment Act, 1921, permits the declaration of hawthorn as a noxious weed, either throughout the district of a local authority, or in a part or parts of the district only, and, furthermore, the planting of hawthorn is prohibited in New Zealand.

TROTTER (A.). **A Walnut disease.**—Abs. in *Boll. mensile della R. Staz. di Patologia vegetale*, ii, 7–9, pp. 106–107, 1921.

In the *Rivista Agraria*, Professor A. Trotter, of the Royal

College of Agriculture at Portici, describes a disease of the walnut-tree met with in the province of Naples, which he calls the 'nerume' or black disease. The attacked trees are restricted in growth, their leaves turn yellow, and the young fruits fall off prematurely in June. In the more severe cases large branches or even the whole tree may wither. Sometimes a blackish mucilaginous fluid exudes through fissures in the bark of the branches, but the most striking and constant symptom is the blackening of the living tissues immediately under the cortex, especially at the base of the trunk, and in the thicker roots. The disease, which seems to present some analogy with the 'mal dell' inchiostro' (ink disease) of the chestnut, is associated with a fungous mycelium in the tissues of the larger roots, extending as far as the collar of the tree, but the pathogenicity of this fungus has not been proved. The diseased walnut-trees grew in a poor and shallow soil, with a rocky, almost impermeable, subsoil, and were thus in conditions unsuitable for their growth.

Departmental Activities: Botany.—*Journ. Dept. of Agric. S. Africa*, iii, 5, pp. 407–408, 1921.

Cases of an onion disease due to *Botrytis allii*, not previously reported by this department, have been received from the Cape. It may be detected, in the growing stages of the plant, by the appearance in wet weather or in the morning after heavy dew of a grey mould on the leaves, followed by the wilting of the affected parts. The most serious consequence, however, is the rotting of the bulb. The fungus infects the leaves at the top of the bulb, then gradually works down and starts a characteristic rot in the bulb which nothing can stop. In order to prevent its spread in the storehouse it is advisable to pick over the onions carefully, and burn any that show the least sign of the disease. In the early stages on the leaves the disease can be checked by spraying with Bordeaux mixture (4–4–50).

Besides crown gall and hairy root of the apple, many cases of the apple-cracking disease caused by *Coniothecium chromatosporum* have occurred, while a disease of apple twigs due to *Phoma mali* has also been reported. The latter usually affects only twigs of young trees, and fruits, the discoloured areas produced on the former having the appearance of being scorched by fire.

Departmental Activities: Botany.—*Journ. Dept. of Agric. S. Africa*, iii, 6, p. 500, 1921.

A disease of the Avocado pear tree, the cause of which is at present unknown, is under investigation. Judging from the severity of the infection and the disastrous results to the tree, it is regarded as likely to prove of a very serious nature. The disease develops in the woody tissues, where it produces grey to brownish, irregular, slightly raised blotches of a cankerous nature.

COOK (M.T.). **Report of the Department of Plant Pathology of the New Jersey Agric. Coll. Exper. Stat. for the year ending June 30, 1920**, pp. 557–577, 1921.

The diseases under investigation are listed. In addition to

subjects noted elsewhere in these abstracts, Dr. Cook worked with the transmission of *Sclerotinia cinerea* from year to year, the causes of tomato fruit rots, and the removal of fruit tree cankers; Dr. W. H. Martin on physiological diseases of potatoes; Mr. C. M. Haensler on spraying pears and cherries, and on egg-plant wilt; and Mr. R. F. Poole on the control of sweet potato and tomato diseases. Among the plant diseases listed as epidemic are root-rot of pea, leaf and fruit spot (*Fabrea maculata*) of pear and quince, *Rhizoctonia* stem cankers of tomatoes and cabbage, and stem rot of sweet potatoes. Under the title 'Falling foliage' (pp. 570–573) Dr. Cook reports that beech and apple leaves turned brown along the margins and between the veins and fell in large numbers during the spring and summer. This is attributed to a period of low temperature while the leaf buds were developing. Spray injury from lime-sulphur, atomic sulphur, and arsenicals was also frequent on the foliage and fruit. Brown rot of the peach (*Sclerotinia cinerea*) was especially severe in 1919, and peach scab and cherry leaf-spot abundant. Under 'Field studies on potato diseases' (pp. 573–577) Dr. Cook reports that blackleg (*Bacillus phytophthorus*) [*B. atrosepticus*], which was destructive a few years ago, is now very rare in New Jersey, probably because of seed certification work. Powdery scab was found not to develop under New Jersey conditions. *Rhizoctonia* is injurious. The amount of infection on the seed tubers was found to be no index of the severity of this disease in the field. Corrosive sublimate gave better results than formaldehyde in seed treatment experiments. Dry rot, attributed to *Fusarium oxysporum*, is common, but not serious. Tipburn of the foliage is most severe during hot weather following a wet season. Mosaic is serious on American Giant and the less grown Green Mountain and Bliss Triumph varieties. It is reported to increase in severity from year to year. Leaf-roll is very serious on the Irish Cobbler variety.

HAYES (H. K.) & STAKMAN (E. C.). **Resistance of Barley to Helminthosporium sativum P.K.B.** — *Phytopath.*, xi, 10, pp. 405–411, 1921.

H. sativum, which causes spot-blotch disease of barley, can also attack wheat, and this or a very similar fungus has been found to be a common cause of foot rot of wheat, rye, and wild grasses, in Minnesota (*Minn. Agric. Expt. Sta. Bull.* 191, 1920). Manchuria barley is fairly resistant, but is unpopular because of its long rough awns. The results of breeding work to produce smooth-awned barleys demonstrated that the question of resistance to *H. sativum* must be considered in the progenies produced.

Crosses were made between Lion, a smooth-awned variety, susceptible to *H. sativum*, and Manchuria, a rough-awned, resistant variety. A study of certain of the F_3 families obtained showed that a gradation occurred, some families being as resistant as Manchuria, some as susceptible as Lion, and some intermediate. It was found that F_3 families could be selected which combined smooth awns and other desirable agronomic and botanical characters with resistance to *H. sativum*. The resistant families were, in

general, the best yielders when the trial plots were exposed to an artificially produced epidemic of spot blotch disease.

The relative resistance of eighteen commercial varieties of barley to *H. sativum* is given, and it is concluded that there is evidence that resistant barleys of any desired botanical group of *Hordeum* can be produced.

VERHOEVEN (W. B. L.). **De strepenziekte van de Gerst.** [The stripe disease of Barley.]—*Tijdschr. over Plantenziekten*, xxvii, 10, pp. 105–120, 4 pl., 1921.

Stripe disease makes its first appearance on barley seedlings when about a month old in the form of two or three pale stripes which become more distinct as time goes on. Finally the tissue dies and a brown discoloration is produced. In severe cases the leaves or even the whole plant may be destroyed.

The early stages of the disease are frequently overlooked, but when the ears are formed the symptoms become much more conspicuous. The dark brown stripes, of which as many as eight may occur on one leaf, run longitudinally and finally split up, giving a frayed appearance to the plant. The discoloration is accompanied by limpness of the leaves, which droop down against the stalk. The leaf-sheaths and nodes may also be attacked, and in moist conditions the formation of spores on the latter can be observed. As a rule the lower leaves are attacked first, the infection gradually spreading upwards. In affected plants all or nearly all the shoots show the disease.

The development of the ears is greatly influenced by the disease, and three types may be distinguished. In the first the ear may emerge entirely from the sheath, the grains being present but not filled. The awns and glumes are limp and darker in colour than the normal. The upper part of the last joint of the stem is also often darker than usual. It is to this type that the disease owes its name of 'deaf ears'. While the healthy ears droop with the weight of ripe grain, the 'deaf' ears stand erect by reason of their lightness. In the second type the ear is arrested in its development, the topmost joint of the stem ceasing to grow before the ear is completely out of the sheath. The awns may emerge but are often misshapen, and there is practically no grain. The third type is the most common; in this there is a complete absence of visible ears, the latter remaining enclosed in the leaf-sheaths.

The diseased plants are scattered among the healthy ones, owing to the fact that infection is chiefly transmitted by the seed.

Stripe disease is caused by *Helminthosporium gramineum*, which forms a mass of spores on the leaves, nodes, and ears of the affected plants. These spores are disseminated on to the healthy grain either during vegetation or at the time of threshing. The sowing of such infected grain usually results in diseased seedlings. Some writers mention the possibility of flower-infection, the fungus reaching the interior of the grain as a result of infection during the blossoming period. The proportion of grains infected in this way must, however, be very small, since thorough disinfection of the surface of the seed reduces the number of diseased plants to a minimum.

Stripe disease of barley is frequently confused with the leaf spot disease [caused by *Helminthosporium teres*], but the two may easily be distinguished by the following points: Stripe disease is characterized by the presence of longitudinal stripes, and spot disease by that of irregular spots, separate and never forming stripes. There is no gradual discoloration of these spots, and the leaves do not split or droop. Furthermore, spot disease occurs in patches, infection being transmitted from one plant to another, and the ears are normally developed in this disease.

The damage caused by stripe disease varies considerably, sometimes amounting to more than half the crop. Early sowing and seed disinfection can do much towards reducing these losses. Different sorts of barley vary considerably in their degree of susceptibility to the disease. Mansholt winter barley III is very susceptible, Mansholt winter barley II being less so. The latter, however, is susceptible to rust. Bochum and Groningen winter barley are moderately susceptible. A new variety, Fletum, appears to be very resistant, but it has not been long enough on the market for thorough testing. As regards summer barley, the Golden variety is fairly susceptible, Princess, Swan's Neck, and Chevalier somewhat less so. Practically speaking, however, the problem of susceptibility is of less importance in this disease than in cases in which treatment is difficult or impossible, since stripe disease can be simply and effectively controlled by seed treatment without undue expense or injury to germination.

The author's experiments during the past few years to test the respective efficacy of a number of fungicides gave unsatisfactory results in the case of formalin, corrosive sublimate, and hot water. With the two former the percentage of diseased plants was increased rather than reduced, while hot water was injurious to germination. The best results were obtained by steeping the seed in copper sulphate, Uspulun, or Germisan B 14, the treatment recommended in each case being as follows: (1) One quarter kg. of copper sulphate dissolved in 3 litres of water per hectolitre of barley. (2) Uspulun solution (at least 1 per cent.), 7 litres per hectolitre of barley. (3) Germisan B 14 (4 per cent.), 3 litres per hectolitre of barley. The last named is only provisionally recommended as it has not yet been fully tested. Great care must be taken to mix the solution thoroughly through the heap so as to wet every grain, a procedure which takes about ten to fifteen minutes to treat effectively a hectolitre of barley.

DONKIN (J. E.). **Bunt-resistant Wheat.**—*Journ. Dept. of Agric. S. Africa*, iii, 6, pp. 561–563, 1921.

The writer gives the results of experiments in testing the resistance to bunt of twenty varieties of wheat, representing all the types grown in South Africa, and including *T. durum*, *T. polonicum*, *T. turgidum*, *T. compactum*, in addition to common wheats (*T. vulgare*), the last named consisting of bearded and beardless, early and late varieties. Carefully selected grains of uniform size were heavily infected with *Tilletia* spores and sown in double rows, one row of each variety being cut off about one inch from the ground as soon as the plants commenced to pipe (this being considered

equivalent to grazing). The outcome of the two years' tests (1918 and 1919) demonstrated the total immunity of the *T. polonicum*, *T. turgidum*, and most of the *T. durum* strains (only one of the latter—Wild Goose—showed a 2 per cent. infection during 1918), while the *T. vulgare* varieties had an average infection of from 19 to 35 per cent. An Indian variety of *T. compactum* (Pusa A 88) was bunted to the extent of 10 per cent. for the uncut and 12 per cent. for the cut plants. The rainfall during the growing season of the 1918 test was nil, while in 1919 there was an inch and a quarter in September.

Whilst the immunity of *T. durum*, *T. polonicum*, and *T. turgidum* varieties has been clearly established under the conditions of these experiments, farmers are advised to continue the growing of the common types in localities where these are successful, as the immune species are not first class milling wheats.

FROMME (F. D.). **Incidence of loose smut in Wheat varieties.**—*Phytopath.*, xi, 12, pp. 507–510, 1921.

During a wheat disease survey in Virginia in 1920 it was observed that all fields of the beardless variety Leap Prolific were practically free from loose smut (*Ustilago tritici*). On the other hand, Stoner, an extensively grown bearded variety, was generally and uniformly infected, most of the fields having about 3 per cent. of smut. Data from other States collected in 1919 showed that Leap averaged 0·1 per cent. infection against 3·6 per cent. for Stoner. In the absence of experimental data it is impossible to state whether this immunity of the Leap variety is a matter of inherent resistance of merely of escape from infection. A superficial comparison of the blooming of the two varieties has not revealed any significant differences which might account for the contrast, both having been seen to open during pollination. Possibly a thorough study of this point may disclose some difference in the duration of exposure or other feature which will provide a mechanical basis for the comparative immunity of Leap.

The available data indicate that, as a group, bearded varieties are more susceptible to loose smut than the beardless. A test carried out in 1921 on twenty bearded and sixteen beardless varieties showed that the average number of smutted ears per row in the bearded group was about three times as much as that found in the beardless (12·7 and 4·6 respectively).

MCKINNEY (H. H.) & JOHNSON (A. G.). **Wojnowicia graminis (McAlp.) Sacc. and D. Sacc. on Wheat in the United States.**—*Phytopath.*, xi, 12, pp. 505–506, 1921.

During a search carried out in Kansas in June 1921 for the perithecia of *Ophiobolus graminis* Sacc. and other organisms associated with a disease having the general field and plant symptoms of take-all or foot-rot of wheat, mature pycnidia of a fungus were rather frequently met with. This fungus agreed in every respect with the description of *Wojnowicia graminis* (McAlp.) Sacc. and D. Sacc. (*Hendersonia graminis* McAlp.) which McAlpine suspected to be the pycnidial stage of *O. graminis*.

Perithecia of the latter were not seen. This appears to be the first record of *W. graminis* in America.

Shortly after this discovery both the pycnidia of *W. graminis* and the perithecia of *O. graminis* were found on dried wheat plants from Arkansas affected with take-all, and also mature pycnidia on plants similarly attacked from Oregon. The pycnidia were found on the lower leaf-sheaths above and below the soil-line. They usually broke through the sheath in the same way as the perithecia of *O. graminis*, from which they are indistinguishable by the naked eye.

Preliminary investigations of the cultural characteristics of the two forms do not indicate any close genetic connexion.

EVANS (N. S.). **'Black point' of Wheat.**—*Phytopath.*, xi, 12, p. 515, 1921.

A comparatively high proportion of the kernels of the durum wheats in the Upper Mississippi Valley are often partially or totally discoloured, especially at the embryo end. Numerous isolations from typically discoloured kernels have given a species of *Helminthosporium* resembling *H. sativum* P. K. & B. A number of inoculations were made in the field at Madison, Wisconsin, water suspensions of conidia being applied to the heads of Acme and D 5 wheat when in flower. Under favourable conditions an abundance of 'black-pointed' kernels resulted.

RUMBOLD (CAROLINE) & TISDALE (ELIZABETH K.). **Phoma insidiosa on Sorghum.**—*Phytopath.*, xi, 12, pp. 513–514, 1921.

The examination of type specimens has now confirmed the authors' provisional determination of this fungus [see this *Review*, i, 6, p. 170]. Search in sorghum seed collections at Washington enabled them to find it on a number of sorghum varieties from China, India, Africa, and Curaçao.

MILLARD (W. A.). **Report on fungoid diseases. In Report on experiments with Wheat conducted at the Manor Farm, Garforth, and in the North Riding, 1921.**—*Univ. of Leeds and Yorkshire Council for Agric. Education Circ.* 123, pp. 8–9, 1922.

In the middle of May 1921 there was a severe outbreak of rust, the enormous number of uredospores produced giving many of the varieties a conspicuous reddish tinge. The attack was one of the worst experienced for many years. As usual in Yorkshire, most of the damage (in this case 99 per cent. of it) was caused by *Puccinia glumarum*. The varieties most affected were, in the following order, Benefactor, Hawk, and White Stand-up. In the case of Benefactor only was the fungus found on the ears between the chaff and the grain as well as on the leaves and straw. None of the wheats was immune, but four varieties, viz. Squarehead's Master, Standard Red, Little Joss, and Iron II were only moderately attacked, the last named being particularly resistant. The relative susceptibity to rust of these varieties corresponds closely with the results of earlier observations.

The only other important fungous diseases of wheat were mildew (*Erysiphe graminis*) and bunt (*Tilletia tritici*). Mildew appeared later in the year than usual, and after the short spell of rain during late July and early August the attack was very severe. Varietal susceptibility was not observed. Bunt was more prevalent than usual, the varieties most affected being White Stand-up and Marshal Foch.

CAMPBELL (J. A.) & TAYLOR (W. H.). **Lemon-Culture: Directions for New Zealand growers.**—*New Zealand Journ. of Agric.*, xxiii, 6, pp. 330–335, 1921.

Notes are given on the symptoms and treatment of the chief diseases of lemons in New Zealand. Brown rot (*Pythiacystis citrophthora*) is stated to be the most troublesome; a full account of it has recently been published [see this *Review*, i, 7, p. 211].

Verrucosis (*Cladosporium citri*), or lemon and orange scab, is characterized by warty excrescences of varying sizes on the fruit and leaves, which become covered with a delicate mould, grey at first, then dusky, and finally black. This condition, which is dependent on an excess of moisture in the atmosphere, depreciates the value of the fruit and debilitates the tree. It can be avoided by preventive spraying with Bordeaux mixture, but where the disease has become firmly established through neglect, a drastic spraying programme with 4–4–40 Bordeaux must be carried out. Three or four applications should be made at intervals of three weeks, commencing when the main crop has set, and resumed again in the autumn.

Melanose (*Phomopsis citri*) affects the fruit, young shoots, and leaves. Small, brown, raised, wax-like spots, profusely scattered over the affected parts, characterize the disorder. The spots coalesce, where plentiful, into irregular patches, which crack in lines. These linear markings arrange themselves into circles or parts of circles, and are diagnostic of the disease. The development of the fruit is inhibited and the resulting disfigurement renders it unattractive. Only young and succulent tissues are subject to attack, fruit approaching maturity becoming immune. Spraying with Bordeaux mixture, 4-4-40, just before blossoming and again when the fruit has set, is recommended.

Anthracnose (*Phoma citricarpa*), also known as black-brand and black-spot, is characterized by the appearance on the fruit of irregular, depressed spots that resemble the markings produced by a searing-iron.

Grey-scab, due to *Sporodesmium griseum*, can be recognized by the formation of small grey or dusky spots on leaves and fruit, which coalesce into well-defined patches. Both these last diseases can be checked by spraying with Bordeaux mixture.

Collar-rot (*Fusarium limonis*) is very prevalent, and no improvement can be looked for until cultural methods have altered for the better. Planting on badly-drained or otherwise unsuitable soil is always followed by disaster, and trees raised by layers or cuttings are admittedly very susceptible. The rot may originate at the collar of the tree, but as a rule the starting-point is at the roots, and the first above-ground symptoms are the sickly and yellow

appearance of the leaves, often followed by the dying-back of the branches. A badly affected tree must be carefully dug out and burned with the roots, and quicklime should be mixed with the soil before replanting. If only one or two roots are affected, these should be cut out and the soil well limed. The same applies to diseased bark, and when the characteristic gummy exudation has ceased the wound should be disinfected, thoroughly scraped, and painted over with coal tar.

Bark-blotch (*Ascochyta corticola*), until recently only recorded as occurring in Australia, has now been observed also in New Zealand; two outbreaks have been reported from the Auckland district in trees of Australian origin. Although this disease in its symptoms and general effect is very similar to collar-rot, the absence of a gummy exudation and the fact that the bark splits and lifts from the wood facilitate differentiation. The treatment is the same as for collar-rot, but the wood laid bare by removal of the bark should be only lightly scraped.

Mottle-leaf is a physiological condition due to malnutrition. Lack of nitrogen causes the leaves to take on a mottled appearance, and the yellow areas of varying extent on them indicate an insufficiency of chlorophyll. In the more acute forms the tree becomes stunted in growth. The only remedy is to apply humus to the soil, as this appears to facilitate the absorption of the various plant foods, more especially nitrogen.

Sooty mould (*Capnodium citricola*), which grows in the secretions of certain scale insects, is avoided by eliminating the latter.

Various insect pests are also discussed and remedial measures recommended. In a paragraph devoted to the question of spray-injury, the authors call attention to a curious fact brought out in recent spraying experiments in Australia, that trees when in a semi-dormant state, instead of supporting stronger solutions as might reasonably have been expected, are on the contrary much more liable to injury than healthy trees in full growth. The prevalent carelessness in mixing sprays is said to be a frequent cause of damage to the trees, and frosts are responsible for a good deal of injury to both fruit and foliage.

McClelland (T. B.). **The Coffee leaf spot (Stilbella flavida) in Porto Rico.**—*Porto Rico Agric. Exper. Stat., Mayaguez, Bull.* 28, 12 pp., 4 pl., 1921.

The leaf spot of coffee is the cause of heavy and continuous losses to growers in Porto Rico, but it is believed that with care many of the abandoned regions could again be worked at a profit, coffee being the most promising crop for certain areas of the Island. The climatic conditions most favourable for the growth of *Coffea arabica* equally foster the development of the disease, Fawcett's description of which (*Porto Rico Agric. Exper. Stat. Bull.* 17, p. 11, 1915), is quoted at length.

In 1917 the renovation of part of an abandoned coffee plantation was undertaken. The annual yield from this plantation was formerly between 300 and 400 quintals, but had fallen off until in some years not more than ten or twelve quintals were obtained. The 1916 crop amounted to forty-eight quintals, and that of 1917

to twenty-eight quintals. The soil and climate were suitable for coffee production, but the trees were in an extremely poor condition owing to continuous defoliation, the leaves being covered with *Stilbella* spots and prematurely shed green leaves being visible on all sides. The part selected for treatment was situated about 3,500 ft. above sea-level. All the trees were cut back to stumps about six to nine inches high, and the plot thoroughly cleaned up, shade trees being also cleared of vines and epiphytes. The area was naturally isolated to some extent, and three rows of banana trees were planted all round the edges to act as a barrier against the adjacent diseased coffee trees.

It was found that a large number of other plants in the plantation acted as hosts for *Stilbella flavida*, including *Bryophyllum calycinum*, *Andira inermis*, *Inga vera*, orange, and others of which the local names are given. It was found advisable to destroy every green plant in the plot except the shade trees, old coffee, and bananas, the young coffee seedlings being particularly dangerous. After about six months the coffee stumps bore shoots from one to three feet high and quite free from leaf spot. Coffee seed was planted a little later, and about a year from the first clearing up less than 1 per cent. of the trees showed any infection. Subsequent results were vitiated by the introduction of diseased seedlings by the occupiers, but the original trees remained practically free from the disease during most of the second year, and the removal of diseased leaves when few in number or the cutting out of more seriously affected plants maintained satisfactory control during the third year.

These results indicate that it should be easy to control the disease by destroying the host plants of the parasite and afterwards maintaining a local quarantine.

After thorough eradication of weeds and grass, the coffee trees should be cut away to six inches above ground, the stump being left with a clean diagonal cut which will allow rain to run off. This should be done immediately after the removal of the crop while the dry season lasts. Whenever possible the entire infected area of a plantation should be cleared at once, but when this is impracticable the most isolated and elevated sections should be attended to first. Any natural barriers present should be utilized; otherwise rows of bananas should be planted close to the edge of the cleared section. Reinfection should immediately be arrested by destroying the affected leaves and branches, or if necessary the whole tree.

Ajrekar (S. L.) & Bal (D. V.). **Observations on the wilt disease of Cotton in the Central Provinces.**—*Agric. Journ. of India*, xvi, 6, pp. 598–617, 1921.

Cotton wilt may result from the action of the stem-borer *Sphenoptera gossypii*, or it may be due to a species of *Fusarium*. The two forms of the disease are easily distinguished: the first by the ease with which affected plants are uprooted, by the swollen condition of the roots, and by the tunnels produced by the insect; the second by a blackish or brownish discoloration of the woody tissues of the root, this being otherwise intact and not swollen. Another distinctive feature of the insect-produced wilt is the

suddenness with which it affects the whole plant at once, this process being usually gradual in the case of the fungous disease, which spreads successively from one part of the plant to another. The present paper deals with the last form only, and the scope of the work undertaken by the authors was restricted to attempts to establish the parasitism of the fungus, to determine the influence of soil conditions on its growth, and to test the alleged immunity of Buri cotton to the disease. Previous research by other workers had already established a marked difference between the American cotton wilt (due to *Fusarium vasinfectum* Atk.) and the Indian disease, and both American and Indian workers have failed to find any direct remedial or preventive measures. The only means, therefore, of checking the disease is to grow resistant varieties, and of these there are a number in the United States, while Buri is said to be immune in India. The Indian cotton wilt *Fusarium* has not hitherto been described or identified.

It is suggested that the wilting of the host plant is brought about through the secretion of a toxin by the parasite, since it does not seem to be altogether accounted for by the mechanical blocking up of the vessels, and a close examination of sections indicated that the majority of the vessels do not contain any hyphae. Attempts to establish the existence of a toxin failed.

For the inoculation experiments four strains of the wilt *Fusarium* were isolated, two from the internal tissues of diseased plants, one from the surface of a wilted plant, and one from infected soil. Three of these strains had easily distinguishable cultural characters, while that from the surface of a wilted plant seemed to be identical with one of those from the internal tissues. Eight series of inoculations on seedlings or seed in pots were carried out, only two of which gave successful results with susceptible varieties of cotton, six plants growing in two pots dying of wilt out of twenty seedlings in one case and one plant out of five in another, the strains of the fungus used being the two obtained from the internal tissues. The remaining inoculations on susceptible varieties (fifty-six plants in ten pots) failed. Buri cotton was inoculated in ten pots (fifty-six plants) without attack, but the irregular results obtained with susceptible varieties prevents a definite conclusion being drawn as to its true immunity. The fungus used for the inoculation was recovered from four of the seven successfully induced cases of wilt, and it is believed that both the internal strains are parasitic. They are described at some length and figured. In spore characters they are alike, but in pigmentation and in the characters of certain sclerotium-like bodies that were developed in culture they differed.

Experiments to test the effect of different antiseptics and other substances added to the soil have been in progress for some time. The results seem to indicate that control of the disease by this means is impossible. No evidence was obtained that any particular manurial treatment of the soil was likely to be effective in checking wilt, the growth of the fungus in the soil solution from different plots of the permanent manurial series on the Nagpur Experimental Farm being uniformly poor in all cases. On the other

hand, steaming the soil or subjecting it to dry heat had some effect in reducing the disease.

The authors describe an experiment in which Buri was grown with susceptible varieties in pots of soil known to contain the wilt-inducing organism in a highly virulent form. Only the Buri plants, but all of these, survived, thus tending to confirm the reported complete immunity of this variety.

VINCENS (F.). **Une maladie du collet des Crotalaires au Tonkin.** [A collar-disease of *Crotalaria* in Tonkin].—*Bull. Agric. de l'Inst. Scient. de Saigon*, iii, 12, pp. 381–384, 1921.

A wilt disease of *Crotalaria juncea* from Tonkin is described and considered to be due in all probability to a *Fusarium* allied to *F. udum* Butl. which the author isolated from the diseased tissues. Other fungi found less regularly associated with the disease (*Neocosmospora vasinfecta*, (?) *Diplodia theobromae*, and species of *Melanospora* and *Cucurbitaria*) are regarded as followers.

The disease begins at the base of the plant, then invades the stem and causes withering and death.

The *Fusarium* isolated forms white or pale rose sporiferous cushions on the surface of the medium in a moist atmosphere, the conidia being 20 to 50 by 2 to 4 μ in diameter, falcate, and with 3 to 5 septa (mostly 3). A *Cephalosporium* form with cylindroid conidia, 5 to 12 by 2 to 3 μ, also occurs.

COCKAYNE (A. H.). **Discussion on the Flax industry.**—*New Zealand Journ. of Sci. and Techn.*, iv, 1, pp. 34–35, 1921.

Speaking at a general session of the New Zealand Science Congress, Mr. Cockayne stated that the Manawatu swamps had been greatly improved by drainage, 23,000 out of 50,000 acres of *Phormium* flax in New Zealand being situated in that region. The gross returns per acre were larger than for any other form of agriculture except fruit-growing. Yellow-leaf disease, however, was causing serious damage, 6,000 acres having been rendered unproductive. The outer leaves of the fans assumed a yellow colour and finally shrivelled up, and the next inner leaves were then attacked. Six species of bacteria were isolated from the roots, none of which gave rise to any pathogenic symptoms on inoculation. Nematodes and insects were also investigated, but they did not occur in sufficient numbers to account for the disease. A fungus, *Ramularia phormii*, was finally isolated and considered to be the cause of the disease. It is not described.

Field experiments showed that only the water-absorbing portion of the root could be primarily infected, i.e. only the secondary or tertiary branches, not the primary root. The fungus, however, spreads to the latter once it has gained a foothold. By destroying the water-absorbing roots the fungus prevents the taking up of water by the plants, so that the disease becomes especially serious during periods of drought. The fungus was isolated, developed in pure cultures, and reintroduced into healthy plants, in which it produced yellow-leaf disease.

Unless the disease can be eradicated, the flax industry will be

ruined. The selection of disease-resistant strains is regarded as a more promising method of control than soil treatment.

ATKINSON (E. H.). **Phormium tenax. Diseases and insect pests.**—*New Zealand Journ. of Agric.*, xxiii, 5, pp. 298–302, 1921.

A preliminary study of yellow-leaf disease of *Phormium* ['New Zealand flax'] has already been carried out by Cockayne [see last abstract], who concluded that the disease was infectious and probably due to fungal or bacterial attack, aggravated by the presence of stagnant water round the plants. The diseased plants frequently recover, especially in the autumn and winter, and a general improvement follows the extension of the root-stock on to more favourable soil. Very few plants are killed outright, and recovered plants appear to be quite equal in production to those which have remained healthy throughout. Cases are quoted, however, where transplanted diseased *Phormium* roots recovered only temporarily and finally died. It has been observed that some varieties are more resistant than others, and their cultivation would probably be the best method of eradicating the disease. More recently Waters has isolated a fungus from the roots of affected plants, in the tissues of which it was fructifying, and this has been identified at Kew as a species of *Ramularia* [*Ramularia phormii*]. Inoculations on the roots of apparently healthy plants resulted in the formation of lesions which proved to contain the *Ramularia*. Experiments are in progress to determine whether the actual yellow-leaf disease can be induced by this parasite.

Little systematic work has hitherto been carried out on the fungi recorded as parasitic on *Phormium*, and their distribution in milling areas and relative economic importance is not known. A species of *Heterosporium* causes large, irregular, sooty blotches on the under surface of the leaves, the fibre underneath becoming red in colour and quite rotten. Badly affected leaves are quite useless for milling, and even a slight attack will cause a loss of many points in grading owing to the bad colour of the fibre. A *Fusarium* causes large, whitish, elliptical areas of dead tissue on young leaves, ruining them for milling purposes. A species of *Phaeoseptoria* is the cause of more or less severe leaf-spotting, accompanied by destruction of the fibre. Another fungus, a *Septoria*, causes longitudinal purple stripes on the leaf, ruining the fibre and killing the whole leaf.

WATERS (R.) & ATKINSON (E. H.). **Yellow-leaf disease in Phormium tenax.** Preliminary report on a current investigation.—*New Zealand Journ. of Agric.*, xxiv, 1, pp. 27–32, 1 fig., 1922.

This disease is marked by the development of an orange discoloration in the foliage, but the authors note that a similar condition may arise from a variety of causes. Search for other distinctive symptoms has failed. The presence of a root rot associated with a fungus in affected plants has been previously noted [see preceding abstracts], but further observations indicate that it can scarcely be regarded as a direct cause of the disease. Not only is the fungus found in the soil of infected *Phormium* flax swamps, but seedlings raised in disease-free swamps, as well as in

nursery and garden soil, may contain it; it is equally common in adult healthy and diseased bushes; and it has been found in all parts of the Dominion in the roots of both *Phormium colensoi* and *P. tenax*, sometimes miles from the nearest area affected by the yellow-leaf disease. Healthy *Phormium* seedlings inoculated at the roots with pure cultures of the fungus sometimes showed lesions, but in no case was the typical yellowing of the foliage produced.

The writers therefore conclude that the presence of the fungus is not in itself an indication of yellow-leaf, but that suitable conditions may convert it into a parasite sufficiently destructive to cause the typical yellowing of the foliage. Experiments are in progress to ascertain what degree of parasitism may be exhibited by the fungus under various environmental conditions.

Meanwhile it is pointed out that no conclusive evidence has as yet been furnished that the disease is of parasitic origin. It has not been found possible as yet to reproduce the disease; seed from healthy and diseased plants sown in sterilized soil with and without subsequent inoculation with *Ramularia*, and even sown in bog soil which had had a diseased crop, has in all cases given healthy plants in the twelve months during which the experiments have continued. In isolations from the finer roots of affected plants which are often discoloured and rotted, six bacteria were obtained, but none was found able to reproduce the disease in healthy seedlings. The same has been the case with other organisms tested. A canker of the rhizome is commonly found in infected plants, and this condition is now under investigation.

The work carried out so far is held to indicate that even if the disease is caused by a micro-organism, the latter must require very special conditions to become pathogenic.

TONNESON (G. A.). **Gummosis of the Cherry.**—*Better Fruit*, xvi, 9, pp. 14–15, 22, 1922.

Field observations have led to the conclusion that autumn growing, with an 'unripened' condition of cambium and sap-wood, is a prevalent cause of gummosis, though bacterial and other factors may be involved. In the State of Washington there are numerous valleys with a rich sandy loam soil, containing ample moisture to keep the trees growing during July and August, and the leaves on such trees frequently provide nutriment as late as December. A sudden drop in the temperature injures the cambium in these cases, with the result that tissues are broken at weak places in the bark and an exudation of gum appears in the following spring. Trees planted on hillside clay soils seldom grow as late as August, and by reason of their earlier maturity they are less liable to gummosis.

Every effort should therefore be made to hasten the process of maturation before the winter season. The sources of nutriment must be reduced and continuous autumn growth checked by pruning from the middle to the end of August, taking off 15 to 25 per cent. or more of limbs and foliage.

After the trees reach the bearing stage there is less liability to gummosis, the surplus nourishment being required for the fruit.

CUNNINGHAM (G. H.). **A fungus disease attacking Blackberry.**—*New Zealand Journ. of Agric.*, xxiv, 1, pp. 23–26, 1922.

Cane-wilt, the most serious disease of raspberries in New Zealand, has apparently begun to attack blackberries in various parts of the North Island. The disease seems to have been first reported in 1921, and a visit to the principal affected areas, with the subsequent examination of diseased specimens, showed the causative organism to be the same as that of cane-wilt, namely, *Leptosphaeria coniothyrium* (Fcl) Sacc. This fungus has two stages in its life-cycle, of which the first, *Coniothyrium fuckelii* Sacc., is actively parasitic and responsible for the destruction of the canes, while later in the season the perfect or ascigerous stage appears on the dead parts.

The effects of the fungus vary somewhat according to the host. On the raspberry (*Rubus idaeus* L.) the infection is more severe than on the blackberry. It is usually confined to fruiting canes, but may also occur on growing shoots, and occasionally on the panicles. A reddish-brown discoloration is the first symptom of disease, rapidly followed by the wilting of some or all of the canes. This is due to the obstruction of the conducting vessels of the phloem and xylem by masses of fungous hyphae. If the cane is attacked at or near its base it dies completely, whereas infection near the apex results only in the death of those parts above the point of attack. Young growing shoots are killed outright, so that in severe cases the succeeding year's crop may be almost entirely lacking.

On the blackberry (*Rubus fruticosus* L.) the infection is relatively mild, occurring chiefly on the panicles. On the canes infection is not followed by wilting, but by the appearance of cankers which gradually result in death. The presence of the fungus may be detected by minute white blisters, formed by the separation of the epidermis from the tissues below on account of the dissolution of the latter by the action of the hyphae. Gradually these blisters expand and coalesce and the epidermis falls away, leaving small irregular cankers in which may be seen the fruiting bodies of the fungus.

Flower and fruit infection is the common condition on blackberry, the nearly mature fruits, their pedicels, and the main axis of the panicle being killed back to the cane. In severe cases the whole panicle, fruit included, turns a pale chestnut colour. When infection occurs in the fruits the hyphae send branches into the drupelets, which are soon drained of their contents. The fungus then works down the pedicel and up into other fruits, or it may attack the lower portion of the peduncle and cut off the food and water-supply of the fruit. The presence of numerous saprophytes, especially *Rhizopus* which forms a dense black mould, often complicates the recognition of the disease. Leaf infection results in the formation of minute dead areas, which fall away and leave small perforations.

Certain varieties of blackberry are more liable to attack than others. A small, semi-prostrate, profusely fruiting variety is invariably badly attacked, while a less common species, somewhat erect, large-leaved, vigorous in growth, but sparse in fruiting, is usually free from disease. Prolific varieties are always small and

stunted in growth, and their free fruiting habit is probably the reason of their greater susceptibility.

American experience has shown that spraying is practically useless against cane-wilt, the spore-containing receptacles being buried in the tissues. The disease being spread from fructifications embedded in drying canes, control measures should be directed rather towards the removal of all infected material. The fungus is much more severe on raspberries than on blackberries, so that its value as an exterminator of the latter, which are amongst the most troublesome of the noxious weeds of New Zealand, must not be over-estimated. Although many hundreds of diseased blackberry-bushes were seen during the visit of inspection referred to above, not one was observed to be destroyed outright. Its introduction into any locality with a view to the extermination of blackberries is therefore most undesirable, since it is more than probable that it would spread to the raspberries in the vicinity, and possibly also to other hosts known to be attacked in America and Europe, such as roses, apples, barberry, elderberry, and willow.

ZUNDEL (P. L.). **The effects of treatment for bunt on the germination of Wheat.**—*Phytopath.*, xi, 12, pp. 469–484, 2 figs., 1921.

Peculiar climatic and soil conditions cause severe losses from bunt in the State of Washington. The treatment by dipping in solutions of copper sulphate, copper sulphate and sodium chloride, or formaldehyde, which are the methods adopted with 99 per cent. of all seed wheat planted in the state, usually results in injury to the seed. The cracking of the kernels, which are usually dry and brittle on account of hot, dry weather at threshing time, allows the fungicide to penetrate the embryo with injurious results.

An extensive series of greenhouse and field tests carried out by the author indicate that the practice of liming after steeping in copper sulphate, which has long been known to reduce seed injury, can be followed with equally good results after formaldehyde. Pre-soaking in water, before using a fungicide, followed by liming, overcame the injury practically completely, but is not adapted for use on a large scale. It is recommended therefore to dip the grain in lime water (1 lb. to 10 gals. for 10 minutes) after treating with copper sulphate or formaldehyde.

BLAKE (M. A.), COOK (M. T.), & CONNORS (C. H.). **Recent studies on Peach Yellows and Little Peach.**—*New Jersey Agric. Exper. Stat. Bull.* 356, 62 pp., 27 figs., 1921.

The present paper is an exhaustive compilation of the observations on 'peach yellows' and 'little peach' made by the authors during the period from 1912 to 1920 at the experimental orchards of Highbridge and Vineland, N. J. The results of the work on the same subject previous to 1912 were published in *N. J. Agric. Exper. Stat. Bull.* 226.

Peach yellows and little peach are American diseases of the peach which are said to occur also on nectarines, almonds, and apricots, and the same or very similar diseases attack the plum. Their cause is not known, but the authors believe them to be of the

same general type as the mosaic and allied diseases of tobacco, tomato, pepper, potato, and other plants. A single tree may be affected with both diseases.

Since its first recorded appearance in the vicinity of Philadelphia in 1791 (it was still, apparently, confined to a small area in 1806) peach yellows has spread in the United States over a region extending from Massachusetts to South Carolina and west to Michigan, Illinois, Missouri, and Kansas. An isolated area in Southern Nevada is also reported. In Canada, the disease is confined to the peach-growing district of Ontario. It has never appeared in California. Little peach, which was not definitely recognized until 1898, occurs from New England as far south as Virginia and west to Michigan, and in some of the other western states in which yellows occurs. Peach rosette, which may be a southern allied or identical disease, does not occur in New Jersey, and is not dealt with.

The two outstanding symptoms of an advanced stage of yellows are: 1. Prematuring of the fruit, which may ripen from a few days to three weeks in advance of the normal time for the same variety. The diseased fruits are commonly more or less spotted and blotched with red instead of the normal 'blush', and in some cases the red pigment may extend through the flesh to the stone, around which the flesh is also of a more pronounced red colour than in healthy fruit; the flavour may vary from nearly normal to insipid or bitter. The premature fruit is very susceptible to brown rot, probably owing to its skin being less resistant. 2. The development of sickly, wiry, and finely branched shoots on the trunk and branches, bearing very narrow leaves and frequently continuing to grow late in the season after the rest of the tree has stopped growing. This symptom, usually considered of equal importance with the former for the identification of the disease, may sometimes appear several seasons after the first one, while in other cases the abnormal shoots may appear on young trees before the fruiting age, and also on bearing trees before prematuring becomes apparent. A yellowish-green discoloration of the foliage is also regarded as a symptom of yellows, but it can be very misleading as many other causes may produce the same appearance and, on the other hand, yellows trees may have a rich green foliage especially if given a good supply of nitrogen. Sometimes the only symptom on young trees and the first to appear on older ones is a rolling of the foliage from the margin inwards, giving the leaves a cylindrical shape. The lenticels of the bark are much enlarged in these cases. Little peach differs from yellows in that instead of prematuring, the fruit remains small and ripens from a few to ten days later than is normal for the variety; the diseased fruits are often flattened and somewhat rectangular in shape. This symptom is combined with a characteristic drooping of the foliage and curling and rolling of the leaves which are usually mottled yellow-green in colour. A similar drooping and rolling of the leaves is a constant feature of the early stages of yellows, especially in young trees. The authors consider that this is the most reliable symptom of the two diseases, though it does not necessarily permit of distinguishing one from the other. It is quite distinct from the drooping and

flaccid condition of the leaves on trees suffering from drought. Young trees affected with yellows are usually checked in growth and assume a more upright and less spreading habit than healthy ones. Vigorous trees with either of the diseases are inclined to push into growth earlier and to bloom in advance of healthy trees, but the growth soon slows down. Practically every symptom of peach yellows and little peach is identical with one or other of the effects produced by other factors, such as girdling of the trees by borers or small rodents, winter injuries, label wires, traumatic wounds to the trunk and roots, other plant diseases, unfavourable soil, improper fertilization, and lack of cultivation. These are all conditions that impose a check on the growth of the tree. For instance, in seasons following cold or severe weather in late winter or early spring, many varieties of peaches may produce a number of small fruits or 'buttons' which cling to the tree throughout the season, but fail to develop to normal size; such cases should not be confused with little peach, from which they can be readily distinguished by the fact that usually some normal fruits are found among the 'buttons', and by the normal appearance of the foliage. A careful examination of each individual case is often necessary in order to avoid an incorrect diagnosis.

In view of the fact that the behaviour of yellows trees, especially the early ripening effect, is very similar to that of healthy trees that have been girdled or whose normal growth has been interfered with by weather, or by injuries, an investigation of the translocation of starch in normal and diseased trees was carried out. Comparative tests showed that in trees mechanically girdled or suffering from winter injury, or affected by yellows or little peach, the starch elaborated during the day by, and stored in, the leaves was not completely transferred at night, but that much remained in the midribs of the leaves at all times. This results in a check to the growth of the tree owing to shortage of food in the growing tissues. The amount of starch remaining in the leaves was found to be in direct proportion to the severity of the disease or the completeness of the girdling or winter injury, but the leaves from trees affected with yellows showed a greater starch content in the early morning than the leaves from girdled trees that had a corresponding rate of growth. Thus the prematuring of the fruits on both yellows and girdled trees is apparently connected with an interference with the process of translocation of the food supply. No explanation has, however, been obtained of the opposite behaviour of little peach trees; in this disease, starch accumulations are also found in the leaves, but the fruit is delayed in ripening instead of ripening prematurely. The peaches on some branches of a yellows tree frequently mature considerably in advance of those on other branches, and starch tests made with leaves from carefully selected twigs clearly indicated that prematuring is in proportion to the severity of the check to growth as measured by the inability to translocate starch. The more advanced the disease in any one branch, the greater is the starch residue found in the leaves in the early morning. The tips of lateral branches of diseased trees often appear quite normal and make a freer growth than those in the

centre of the tree; tests made in the early morning showed much less starch in the growing tips than in the older parts of the twigs.

It was observed at the New Jersey Station that peaches of the same variety and coming from a single nursery differed greatly in susceptibility to the diseases when divided and planted on two different pieces of land, although only a quarter of a mile apart; one lot suffered considerable losses from yellows and little peach, while the other was only slightly affected. On the other hand, no influence was found to be exercised by the use of different fertilizers in the orchards, though the experimental plots received widely different treatment in this respect. The writers were also unable to observe that variety exerts any influence upon resistance or susceptibility to these diseases.

Pits from fruits which premature much in advance of the normal usually fail to germinate, but pits from slightly diseased branches may develop and produce seedlings; all the trees produced at the Station from such pits have proved to be healthy. Pollination experiments with pollen from diseased trees indicate that pollen is not a carrier of the infection. Inoculation experiments with the juices from leaves of yellows and little peach trees, and also from premature yellows fruits inserted into healthy trees, gave negative results, while, as is well known, the buds from trees diseased with yellows invariably convey the disease when budded upon healthy stock. A series of experiments was carried out in order to determine the incubation period of yellows. This was found to differ according to the virulence of the disease in the tree from which the buds were taken. The shortest period noted was from August of one year to spring of the next. This was with buds from a tree which suddenly developed acute symptoms in a large number of branches without any preliminary symptoms. In other cases the first wiry shoots began to develop two years after budding. In general the observations indicate that the disease may be present in a tree sometimes for as much as four or five seasons before even suspicious symptoms appear. Buds taken from apparently healthy parts of a diseased tree usually transmit the disease. In one case buds were taken from the healthy and diseased parts of a tree that had only a single small branch affected. Those from this branch gave the disease the following year while none of the others did so that year, and it was not until after five years that all the budded trees were affected.

Where diseased trees are left growing in an orchard they become centres of infection, surrounding trees gradually becoming diseased. It is not known, however, whether this is due to direct infection in some unknown manner or to environmental conditions favouring the disease in particular areas, but there is strong evidence against the spread of infection through the soil. Trees replanted where diseased trees have been removed are not more liable to become affected than any others. Infection through the agency of pruning tools is also considered to be very doubtful.

The number of new cases each year was recorded in certain orchards from the first planting. In general the increase was progressive, but it was much more rapid in some years than in others. [Apparently the diseased trees were removed each year.]

Little peach was the more common of the two diseases in these cases. Epidemics of yellows or of little peach have occurred in the Vineland orchards about every ten or fifteen years. In 1907 there was an epidemic of yellows, in 1920 one of little peach. From this and other observations the authors are inclined to regard the two diseases (and also rosette) as forms of a single disorder. In the periods between epidemics very few trees become attacked until at least the fourth or fifth season after planting, but during epidemics trees of all ages are affected.

Many of the estimates of the losses due to yellows or little peach that have been made are unreliable, as there is little doubt that in many supposed cases of yellows the symptoms were due to other causes and the losses were over-estimated. Even making allowance for such errors, however, the losses are very considerable. According to the authors' observations, in districts where the diseases prevail, from 1 to 3 per cent. of the trees are liable to develop unmistakable symptoms annually in quiescent periods, while during epidemics the proportion of trees infected can reach 25 per cent. or more in a single year.

A brief summary of measures recommended for minimizing the losses due to yellows and little peach is appended. Apart from ordinary sanitary precautions and the use of good stock, the chief recommendation is the immediate removal of all diseased and suspicious trees.

[An abstract of the investigations on the dissemination of these diseases reported in this Bulletin is contained in *Phytopathology*, xii, 3, pp. 140–142, 1922].

FROMME (F. D.), RALSTON (G. S.), and EHEART (J. F.). **Dusting experiments in Peach and Apple orchards in 1920.**—*Virginia Agric. Exper. Stat. Bull.* 224, pp. 1–12, 1921.

Tests were made with Bordeaux mixture; with a sulphur dust containing 80 parts dusting sulphur, 10 parts lead arsenate, and 10 parts hydrated lime; with copper-lime dust 10–10–80 (10 parts dehydrated copper sulphate, 10 parts lead arsenate, and 80 parts hydrated lime); with a similar dust except in the proportion 5–10–85; with Bordeaux dust; and with lime sulphur sprays.

A fruit-crack was quite serious on peaches dusted with the sulphur dusts, probably induced by the dust and excessive moisture. The 1920 results, supplementing those obtained in 1919, indicate that sulphur-dust is satisfactory for the control of peach scab. The data with respect to the control of brown rot and curculio of the peach are considered insufficient for drawing conclusions.

From the apple-dusting experiments, neither copper-lime dust nor Bordeaux dust gave sufficiently good control of scab to warrant their use. None of the dust mixtures was found to be effective enough against bitter-rot to warrant its use in Virginia.

A preliminary list of the diseases of cultivated plants in Ceylon.—*Dept. of Agric., Ceylon, Bull.* 52, 24 pp., 1922.

This list has been compiled by the staff of the Division of Botany and Mycology of the Ceylon Agricultural Department primarily with the object of furnishing information which will enable other

countries to know what are the chief diseases of plants of economic importance in Ceylon. It is pointed out that most countries have adopted legislative measures to protect their crops from the ravages of introduced diseases, but that these measures are not always based on a sufficiently accurate knowledge of the diseases that can be introduced from any particular area. Obviously the first requirement of a country which wishes to protect itself from foreign diseases is to know what it should guard against in each area, otherwise the restrictions may be arbitrary or useless.

The diseases recorded total 415, and are arranged under 174 host plants, including, in addition to those of agricultural and planting interest, a number of forest trees and ornamental plants. The list is invaluable as an addition to knowledge of the distribution of a large number of the fungous parasites of tropical plants.

PARISI (ROSA). **Di alcuni parassiti delle piante medicinali e da essenze.** [Notes on some parasites of medicinal and aromatic plants.]—*Bull. Orto. Bot. Napoli*, vi, pp. 285–296, 1921.

Several parasites of medicinal and aromatic plants cultivated in the Royal Botanic Gardens, Naples, are described.

Physoderma debeauxii Bubák is responsible for serious damage to *Scilla maritima*. The disease generally develops in the rainy season, forming elliptical spots on the leaves, with the long axis parallel to the veins. These spots have a raised, pad-like, greyish-green, and shiny margin, and are sharply defined from the already yellowed leaf surface by a light green halo. The chlorophyll in the centre of the spot is destroyed, but persists longer than in any other part of the leaf in the light green zone, no doubt as a result of the stimulating action of the fungus. The latter occupies chiefly a dark violet or reddish-grey area in the centre of the spots, producing fine intracellular hyphae with ganglionic swellings and numerous round, yellowish-brown, finely warty spores, of which there may be six or seven in a single cell and which are from 14 to 28 μ in diameter.

Uromyces rumicis (Schum.) Wint. attacks the foliage of *Rumex patientia* in the spring, causing discoloration and premature shedding of the leaves.

Thielavia basicola Zopf. was found as a parasite on *Atropa belladonna*, apparently a new host. Its attacks are favoured by excessive humidity, lack of aeration in the soil, and abundant manuring, conditions which are generally found in hothouse cultivation. Seedlings transplanted in the open and freed from animal parasites were able to throw off the disease. Others that were taken from the greenhouse and planted near a wall which sheltered them from the sun's rays and from winds showed a loss of 90 per cent. from *Thielavia* infection.

Ramularia variabilis Fel is a widely-distributed parasite of *Digitalis purpurea*. The most resistant variety so far encountered is *tomentosa* of Sardinia. Cavara is quoted as stating that *Digitalis* plants attacked by this fungus are considerably reduced in physiological activity, and are therefore inferior medicinally to healthy plants. *Heterosporium gracile* (Wallr.) Sacc. appeared on the leaves of *Iris pallida* in the spring, and the disease spread during

the summer and autumn, all neighbouring plants being rapidly infected. Two new species of *Macrosporium* are described, *M. papaveris* and *M. cavarae.* The former was found on *Papaver somniferum*, causing large velvety black spots, especially on the green capsules. It differs from *Alternaria brassicae* var. *somniferi* Hart. & Br. in having long and pluriseptate fertile hyphae as compared with the short, torulose, 1- to 2-septate hyphae of the *Alternaria*, the conidia being rounded at the apex, 5- to 7-septate, 34 to 51 by 10 to 12 μ in diameter, and with a short pedicel, instead of being constricted at the apex, 5- to 9-septate, 52 to 80 by 13 to 40 μ, and with a long pedicel. *M. cavarae* attacks several species of *Ricinus*, including *R. borboniensis*, *R. gibsoni*, and *R. viridis*, causing round, brown or yellow, slightly zoned spots, with a dark coating of conidiophores, on the leaves, which ultimately dry up and are shed. The cotyledons and first leaves of seedlings were also attacked with considerable virulence. It is said to have developed especially on plants fertilized with calcium cyanamide. *Macrosporium solani* Ell. and Mart. (*Alternaria solani* Sorauer) was found on *Datura stramonium*, *D. metel*, *D. fastuosa*, *Hyoscyamus albus*, *H. niger*, and *Atropa belladonna*. The damage done to the leaves, and in the case of the species of *Datura* to the calyx and corolla as well, may assume serious proportions on account of the fact that the yellow-green colour of diseased parts is not confined to the spots actually invaded by the mycelium, but extends to the whole of the attacked organ, which ultimately dries up and falls off. From this it is concluded that the fungus exercises a toxic action on the cells outside the limits of its growth.

A fungus which is identified with *Septoria melissae* Desm. occurs commonly on the leaves of *Melissa officinalis* in the medicinal garden, forming numerous small brown spots dotted with the pycnidia. The affected leaves become shrunken, dry, and fall off, leading to considerable damage. From its characters it is transferred to the genus *Phleospora* as *P. melissae* (Desm.) Parisi.

Peyronel (B.). **Nuovi casi di rapporti micorizici tra Basidiomiceti e Fanerogame arboree.** [New cases of mycorrhyzic association between Basidiomycetes and arborescent Phanerogams.]—*Bull. Soc. Bot. Ital.*, Anno 1922, i, pp. 7–14, 1922.

The following is a list of the new cases of mycorrhizal association between four species of trees and thirteen species of Basidiomycetes observed by the author at Riclaretto in the Valli Valdesi in 1920.

On *Fagus silvatica*: *Cortinarius proteus*, *Boletus cyanescens*, *B. chrysenteron*, *Hypochnus cyanescens* n. sp., *Scleroderma vulgare.* On *Corylus avellana*: *Lactarius coryli* n. sp., *Boletus chrysenteron*, *Strobilomyces strobilaceus*, *Hypochnus cyanescens.* On *Betula alba*: *Amanita muscaria*, *Lactarius necator*, *Boletus scaber* f. *betulae*, *Scleroderma vulgare.* On *Larix decidua*: *Amanita muscaria*, *Russula laricina* n. sp., *Hygrophorus bresadolae*, *H. lucorum*, *Scleroderma vulgare.*

The new species in this list will be described elsewhere. The present paper is a brief record of the more striking features noted by the author in his study of these associations. Most conspicuous

of all is the fact that both the form and dimensions of the mycorrhiza seem to depend chiefly, if not exclusively, on the phanerogam symbiont. Larch mycorrhiza, for instance, although produced by many different Basidiomycetes, are all of more or less the same type and dimensions; the slight differences observed are attributed rather to the varying nature of the soil than to specific differences in the symbiotic fungi. These mycorrhiza are conspicuous by their large dimensions in comparison to those of broad-leaved trees. In the latter also the mycorrhiza are very similar to each other, though some differences can be detected on close examination. *Scleroderma vulgare* forms, on the larch, mycorrhiza which macroscopically differ but little, if at all, from those of *Boletus elegans* or *B. laricinus*, while on the beech it produces much smaller mycorrhiza very much like those formed on this tree by *Boletus cyanescens* and *B. chrysenteron*. On the other hand, the fungal mycelium is naturally the principal factor in determining the structure, thickness, colour, &c., of the mycorrhizal covering, or, as the author calls it, 'mycoclena' (fungous mantle). In the author's opinion, the differences in these points are so conspicuous that it will eventually be possible to compile an analytical key which will allow of the immediate identification of the fungus producing the mycorrhiza by simply examining the mycoclena; for the most part they are of a microscopical nature, but generally they are accompanied by morphological characteristics which, with some experience, are noticeable to the naked eye. Thus the mycorrhiza formed on *Larix decidua* by *Boletus elegans* generally differ from those produced by *B. cavipes* in that while the latter are of a pure white colour, smooth, and have mycelial strands which mostly start only from their base, the former are milky or greyish-white in colour owing to the lesser thickness and laxer texture of the mycoclena (which forms a semi-transparent veil, especially over the tips of the rootlets), and the mycelium radiates from all parts of the surface of the mycorrhiza like a delicate cobweb, usually without forming definite strands. Still more prominent macroscopic distinctive features are supplied in some species by the colour of the mycelium. Thus the mycorrhiza formed by *Hypochnus cyanescens* on *Fagus silvatica* can be immediately recognized by the fine blue colour, and that of *Strobilomyces strobilaceus* on *Corylus avellana* by the fuliginous colour of the mycelium. Of peculiar interest, from the point of view of pigmentation, is *Scleroderma*, which, under conditions not quite elucidated as yet, sometimes forms mycorrhiza of a bright canary yellow on the larch and on the beech besides its usual white ones; this colour is perhaps due to a greater thickness of the mycoclena, since the thicker mycelial strands are yellow, while the thinner ones are white.

Although a mycorrhizal association with a particular species of tree can be formed by several species of fungi, two or more fungi very seldom combine in forming a single mycorrhiza or even a bunch of mycorrhiza on the same tree. Sometimes, however, mycorrhizal groups produced by one species of fungus can be observed on the same root as bunches of mycorrhiza formed by another species, though these are rather exceptional cases.

In general there is a close connexion between the environment in

which the mycorrhiza develop and the specific nature of the fungi producing them. Each species of fungus grows by preference under certain oecological conditions determined by the greater or lesser compactness of the soil, the greater or lesser richness of the latter in organic matter and moisture, the presence or absence and the constitution of the grass turf, the situation and configuration of the ground, and the like.

The author's observations lead him to be almost certain of the following mycorrhizal associations, in addition to those already reported. On *Larix decidua*: *Amanitopsis vaginata*, *Lactarius rufus*, *Gomphidius gracilis*. On *Fagus silvatica*: *Lactarius blennius*, *L. volemus*. On *Corylus avellana*: *Boletus scaber*, *Cortinarius proteus*. On *Betula alba*: *Boletus subtomentosus*, *Amanitopsis vaginata*. On *Castanea sativa*: *Lactarius volemus*, *Boletus subtomentosus*. On *Quercus robur*: *Lactarius volemus*, *Scleroderma vulgare*, *Boletus scaber*. On *Populus tremula*: *Russula virescens*, *Cortinarius collinitus*.

It is stated that each species of Basidiomyceteae normally assumes a different aspect and size according to the species of tree with which it stands in mycorrhizal association; thus *Boletus scaber* in association with *Betula alba* is generally larger and has a thicker set stalk and a lighter coloured pileus than the forms associated with the hazel nut, oak, and chestnut. *Boletus rufus*, so different by its size and colour from the preceding species, is perhaps nothing else but a specialized form of it resulting from its association with *Populus tremula*. If greater attention were paid to these relations between fungi and particular species of trees, a guide might be found to some of the problems in the systematic study of the Hymenomycetes.

MURPHY (P. A.). **Some recent work on leaf-roll and mosaic.** *Royal Hort. Soc. London, Rep. Internat. Potato Conference of 1921*, pp. 145-152. [Received March 1922.]

Leaf-roll and mosaic of potatoes occur to some extent in Ireland, but certain varieties (of which a list is given) appear to be resistant to one or the other disease, and Great Scot appears to be resistant to both. Further evidence is given of the transmissibility of leaf-roll between adjacent plants. The effect of leaf-roll on starch translocation is shown by iodine tests on leaves from diseased and healthy plants. In the case of secondary leaf-roll, starch is to be found in lower leaves taken in the morning (up until 11 a.m.), whereas similar healthy leaves do not stain black with iodine. This test cannot always be relied on in primary leaf-roll, but in such plants the upper leaves may also show starch accumulation. This is a convenient method of diagnosing leaf-roll, and may be applied to plants sent through the post.

Under warm and dry climatic conditions mosaic symptoms in potatoes may not appear, but the infectious principle is nevertheless often present in a latent condition.

'Rust' is a name given by growers in certain parts of England (particulary the south) to a condition covering many types of diseased plants, including (1) spotting and colouring of leaves, plants dwarfed, leaf-roll present; (2) browning and bronzing of

leaves, similar to 'potash hunger'; (3) 'physiological leaf spot' with sharply defined, black, angular spots; (4) plants resembling 'streak' of America and also similar to one phase of the bacterial ring disease of Appel, and to the author's 'leaf-drop'; (5) plants showing symptoms of the author's 'crinkle'. Of these the most destructive seem to be leaf-roll, bronzing, and crinkle, in this order.

The author discusses crinkle briefly, and considers that the evidence indicates that it is distinct from mosaic.

The value of some system of inspection of potatoes in the field is urged, in order that a grower may know the character of the plants from which he takes his seed tubers.

SALAMAN (R. N.) & LESLEY (J. W.). **Some information on the heredity of immunity from wart disease.** *Royal Hort. Soc. London, Rep. Internat. Potato Conference of 1921*, pp. 105–111. [Received March 1922.]

The authors present a preliminary report of experiments devised to test the mode of inheritance of immunity to wart disease in potatoes. Selfed families were grown from two immune varieties, Leinster Wonder and Edzell Blue, of which the former gave 14 immune and 4 susceptible, while the latter gave 22 immune and 6 susceptible. In a cross between two immune varieties, Golden Wonder and Leinster Wonder, 14 seedlings were immune and 7 susceptible. This suggests that all three are heterozygous for a single immunity factor, immunity being dominant. Another cross between immunes, Kerr's Pink and Champion II, gave 76 immune and 3 susceptible, and here there is clearly more than one factor concerned, the results corresponding fairly closely with the presence of two factors, either of which confers immunity. Crosses between certain susceptibles and immunes gave about half and half susceptible and immune, as would happen if the immune parent had one of the immunity factors and the susceptible had neither. A selfed susceptible gave results that require further testing, but combined with the results of other crosses, which are described, they suggest that certain susceptibles contain a factor which inhibits an immunity factor. It would appear, therefore, that immunity is of two kinds each due to a distinct factor, though both may occur together, and that susceptibility is also of two kinds, one merely due to an absence of both the immunity factors, and the other due to the presence of one of these factors with at the same time a factor which inhibits it.

Some varieties are preferable as susceptible parents on account of their factorial composition, and the same is true of the immunes; both parents must be considered in breeding immune varieties. No correlation has been observed between behaviour to wart disease and flower colour or tuber colour. The authors have not yet found a homozygous immune.

LAVERAN (A.) & FRANCHINI (G.). **Contribution à l'étude des insectes propagateurs de la flagellose des Euphorbes.** [Contribution to the study of insect propagators of flagellosis in Euphorbias.]—*Bull. Soc. Path. exot.*, xiv, 3, pp. 148–151, 1921.

Since insects are frequently attacked by flagellates of the genus

Herpetomonas it was natural that latex-sucking insects should be regarded as probably responsible for the presence of flagellates in the latex of species of *Euphorbia* when this condition was discovered. In 1910 Lafont observed the occurrence of flagellates in *Nysius euphorbiae* (Hemiptera of the family Lygaeidae) feeding on *E. pilulifera* in Mauritius. Using fifty insects he succeeded in transmitting flagellosis from an infected to a non-infected *Euphorbia* of the same species. In Dahomey Bouet and Roubaud found that *E. pilulifera*, which is very liable to flagellosis, was the food plant of numerous Hemiptera, especially *Dieuches humilis* of the family Lygaeidae. Flagellates were found in large numbers in a nymph of this species, but an examination of the proboscis and salivary glands gave negative results. Of ten *Dieuches* nourished for a week on infected *Euphorbia* two had flagellates, and a transmission experiment was also successful.

According to Patton and Cragg in India, *Lygaeus pandarus* (*militaris*) is common on *Calotropis gigantea*, a latex-bearing plant, and is almost always infected by *Herpetomonas lygaei*, which also attacks *L. hospes*; *Nysius minor*, which feeds on the latex of *E. pilulifera*, is in all probability the invertebrate host of *Herpetomonas davidi* which occurs in the latex of *Euphorbia*.

In 1914 C. França pointed out that the presence of flagellates had only been observed in the digestive tract of different Lygaeidae, not in the proboscis or salivary glands, and that these insects could not be regarded as the animal hosts of *Herpetomonas davidi*. In 1920 the same writer, studying flagellosis in *E. segetalis* in Portugal, came to the conclusion that *Stenocephalus agilis* was the primary animal host of the flagellates of *Euphorbia*, and the agent transmitting the infection from one plant to another. Flagellates were found in the intestine, proboscis, and salivary glands, while encysted forms occurred in the rectum.

The present writers, having noticed frequent instances of flagellosis of *Euphorbia* in and near Bologna, wished to ascertain whether *Stenocephalus agilis* occurred on these plants in Italy. They collected about 200 insects which were sucking the latex from *E. falcata* and *E. dulcis*. Flagellates were found twice in ? *Nysius* sp. and twice in Lygaeidae, genus undetermined, while Leishmaniform elements were twice observed in the digestive tract of *Calocoris*. In the digestive tract of one of the Lygaeidae (probably *Nysius*) were large numbers of spirochaetes, 14 to 24 by 0·5 μ, with four spirals. Flagellates of the *Herpetomonas* type occurred frequently in the digestive tract of *Anopheles bifurcatus* and *Culex penicillaris*. *Stenocephalus* was in no case observed either in the larval or adult stage. The latex-sucking insects collected at Bologna were of two families and four species: (1) Lygaeidae: ? *Nysius* sp. and ? *Lygaeus* sp.; (2) Cimicidae: *Calocoris chenopodii* and *Megalocerea ruficornis*.

It would seem that the *Nysius* referred to above as occurring on *Euphorbia* in Mauritius and elsewhere was rightly suspected of transmitting the flagellosis of these plants. Should further researches show infection of the proboscis and salivary glands of these insects, their role as the primary animal host of *Herpetomonas davidi* in certain regions will be established. The absence of

Stenocephalus from the insects collected at Bologna suggests at least that other species may equally well act as hosts of *Herpetomonas davidi.*

[This and the following abstracts, though dealing with the protozoa found in plants, are included because of their obvious interest to phytopathologists, especially to those working on mosaic and allied diseases].

MESNIL (F.). **La 'Flagellose' ou 'Leptomoniase' des Euphorbes et des Asclépiadacées.** ['Flagellosis' or 'Leptomoniasis' of Euphorbias and Asclepiadaceae.]—*Ann. Sci. Nat.*, Sér. X, iii, 5–6, pp. xlii–lvii, 4 figs., 1921.

The subject is discussed under the following headings: 1. History of the subject [see last abstract]. 2. Species of *Euphorbia* infested and geographical distribution. 3. Effect on the *Euphorbia*, describing the views of Lafont and França, both of whom insist on the pathological nature of the phenomenon. França states that although the invading organisms are restricted to the laticiferous apparatus, they exercise an influence on the cellular tissue, depleting the starch content and eliminating the chlorophyll. He has also observed the atrophy of heavily infected branches, and agrees with Lafont in holding that infection may result in etiolation and wilting. 4. Morphology of *Leptomonas davidi* in the *Euphorbia*. 5. Methods of transmission and evolution of *Leptomonas* in Hemiptera of the genus *Stenocephalus*. The life cycle of the parasite in the latex and in *Stenocephalus agilis* is figured after França. 6. Leptomonads of the *Asclepiadaceae*. 7. Affinities of the vegetable leptomonads, which are stated to belong to the family Trypanosomidae. The generic name *Leptomonas*, used by Lafont and França, is retained, though the author points out that the correctness of this name as against *Herpetomonas* is still under discussion, and that Donovan has proposed that the plant-inhabiting forms should be named *Phytomonas*. The resemblance of certain stages of *Leishmania* recently described by Mrs. Adie in the bed-bug to similar forms in *Stenocephalus* is noted. A bibliography is appended.

FRANCHINI (G.). **Sur un trypanosome du latex de deux espèces d'Euphorbe.** [On a trypanosome of the latex of two species of *Euphorbia*.]—*Bull. Soc. Path. exot.*, xv, 1, pp. 18–23, 1 fig., 1922.

For a considerable time the latex of *Euphorbia nereifolia* and *E. coerulescens* in the Botanical Garden at Florence has been under observation on account of the presence in it of an unknown organism. The latter was sometimes round, sometimes oval or elongated, with a nucleus and granulations in the protoplasm, but no flagellum. Genuine trypanosomes and a series of other forms were eventually found in the latex. The trypanosomes are of two kinds, large and small, the former measuring 8 to 10 by 1 to 2 μ and the latter 4 to 8 by 1 to 1·5 μ. They are U-shaped, the two branches gradually converging. The organism remains in the latex during the winter, when the temperature sometimes falls to zero C. It is thought that besides the free forms found in the latex there are other forms enclosed in the tissues of the plant.

This trypanosome presents closer analogies of development with certain trypanosomes of vertebrates than with those of insects, and is regarded as a new species, *Trypanosoma euphorbiae.*

Among the obligate phytophagous insects of the Botanical Garden at Florence, the following harboured flagellates in their digestive tract: Pentatomidae: *Pentatoma ornata, P. ornata* var. *pectoralis, P. juniperina, Psacasta cerinthi,* and *Graphosoma lineatum* var. *italicum* (flagellosis, caused by *Crithidia* n. sp., was less frequent in the two last named.) Pyrrhocoridae: *Pyrrhocoris apterus* (*Herpetomonas* was present in 50 per cent. of the specimens examined, the coelomic fluid, salivary glands, and proboscis being infected). Lygaeidae: *Lygaeus saxatilis* (*Herpetomonas* n. sp., in the digestive tract), *Oxycarenus lavaterae* (these insects are particularly numerous on *Althea syriaca* (Malvaceae), and 20 per cent. contained numerous *Crithidia* in their digestive tract.)

Among occasionally phytophagous insects the following contained flagellates in their digestive tract: Muscidae: *Musca domestica, Calliphora erythrocephala, Sarcophaga haemorrhoidalis,* and *Lucilia sericata* (all of which harboured *Herpetomonas* and more rarely *Trypanosoma*). Culicidae: *Anopheles maculipennis, A. bifurcatus, Culex pipiens,* &c. (*Herpetomonas, Crithidia,* and sometimes *Trypanosoma* in *A. maculipennis*). Psychodidae: *Phlebotomus papatasi* (*Herpetomonas* rather rare in the digestive tract).

FRANCHINI (G.). **Sur un flagellé nouveau du latex de deux Apocynées.** [On a new flagellate of the latex of two Apocynaceae.]—*Bull. Soc. Path. exot.*, xv, 2, pp. 109-113, 1 fig., 1922.

Two species of Apocynaceae, *Funtumia elastica* and *Thevetia nereifolia*, cultivated at the Agricultural College in Florence, were examined for the presence of protozoa in the latex. The same organism was found twice in the latex of the trunk, the young branches, and the leaves of one of the four specimens examined, a *Funtumia.* The protozoon was generally elongated, and the flagellum frequently absent, or very short. In exceptional cases the flagellum was longer than the protozoon. The nucleus was medially placed, generally spherical, and often surrounded by a rounded or oval clear space. There was a small rod-shaped blepharoplast in the front of the body, but very rarely a rhizoplast. Divided and U-shaped forms were frequent, small Leishmaniform bodies rare. Besides the elongated or flagellate forms there were round or oval forms of varying dimensions, sometimes with several chromatic masses in the protoplasm. Some of the divided forms with two nuclei and two centrosomes were more or less constricted in the middle, and in these cases the centrosome was situated near the centre of each half, not at the periphery.

Large spherical or oval organisms with pale protoplasm, containing several chromatic masses and vacuoles, were also observed and thought to be in process of degeneration. Thick-walled, nucleated, encysted forms, without a centrosome, were present.

Besides the free forms, there were also oval elongated bodies enclosed in special formations (cells?). These enclosed bodies were somewhat smaller than the free forms, but otherwise similar. Two,

three, or more were enclosed in a single cell, the dimensions of which ranged from 7 to 15 μ in length and 4 to 10 μ in width.

A protozoon similar to the foregoing was observed in the latex of a *Thevetia nereifolia* situated in close proximity to the infected *Funtumia*. Flagellate forms, however, were absent, and elongated forms less frequent. The large spherical or oval forms with several chromatic masses in the protoplasm predominated. The *Thevetia* was much less heavily infested than the *Funtumia*. Probably the same insect inoculated the organism into both plants, which did not seem to be adversely affected by its presence. The protozoon is probably a flagellate of the genus *Herpetomonas* or a similar form, any divergence from the normal being explained by the unaccustomed medium.

FRANÇA (C.). **Encore quelques considérations sur la flagellose des Euphorbes.** [Some further observations on flagellosis of *Euphorbia*.]—*Bull. Soc. Path. exot.*, xv, 3, pp. 166–168, 1922.

The writer maintains his conclusion, challenged by Laveran and Franchini [see abstract above, p. 307] that *Stenocephalus agilis* is the primary host of *Leptomonas* [*Herpetomonas*] *davidi*. The connexion between the presence of infected *Stenocephalus* and the flagellosis of *Euphorbia* has recently been demonstrated by Prof. Galli-Valerio (*Schweizer. Mediz. Wochenschr.*, L, 1921) on *Euphorbia gerardiana* Jacq. (=*E. seguieriana* Necker).

Attention is drawn to the discovery by Mrs. Helen Adie (*Indian Journ. Med. Res.*, Oct. 1921) of the life-cycle of *Leptomonas donovani* in *Cimex lectularius*.

FRANCHINI (G.). **Flagellose du Chou et des punaises du Chou.** [Flagellosis of the Cabbage and of Cabbage bugs.]—*Bull. Soc. Path. exot.*, xv, 3, pp. 163–165, 1 fig., 1922.

Bugs of the family Pentatomidae were found on cabbages near Bologna, the species most frequently being *Pentatoma ornatum*, *P. ornatum* var. *pectorale*, *P. oleraceum*, and *Ælia acuminata*. With the exception of the last named, these species frequently harboured flagellates (*Crithidia* and *Herpetomonas*) in their digestive tract, and occasionally in their salivary glands and proboscis. The excreta of these insects contained many flagellates and Leishmaniform bodies with thick walls (cysts). The larvae were also infected. Clusters of greyish eggs adhered to the under surface of some of the cabbage leaves, causing them to turn yellow and die.

The flagellates referred to above contained granular protoplasm (*Herpetomonas* type), but were sometimes provided with a small membrane. The long flagellum originated from the centrosome, which was generally situated at some distance from the nucleus, but occasionally adjoined it. Elongated forms without flagella (Leishmaniform) were not infrequent. Elongated, helicoidal bodies without flagella, distributed in clusters, and other small slender bodies in bundles, with or without centrosomes, were also observed. Encysted forms were not infrequent. The dimensions of the flagellates were 7 to 15 (occasionally 22) by 1 to 1·5 μ, the flagellum generally being very long. The Leishmaniform oval bodies were

2 to 6 by 1 to 2 μ or 2 to 3 μ in diameter. The round cysts were 2 to 3 μ in diameter, and the oval 2 by 1 to 1·5 μ.

On the upper surface of the cabbage leaves the presence was frequently observed of Leishmaniform or elongated thick-walled bodies, without a flagellum, doubtless expelled with the excreta of the insects. The leaves should be well washed before examination. The presence of the bacillus *Pseudomonas campestris* could not be detected.

Flagellosis of the cabbage bugs is infrequent, that of the cabbage itself much less so. The organism perhaps penetrates the tissues of the plants as a result of the insect punctures, and may possibly pass from their excreta into the leaves.

LAVERAN (A.) & FRANCHINI (G.). **Spirochétose de punaises des Euphorbes et du latex.** [Spirochaetosis of *Euphorbia* bugs and latex.]—*Bull. Soc. Path. exot.*, xiv, 4, pp. 205–207, 2 figs., 1921.

Numerous spirochaetes were found in the digestive tract of Lygaeideae captured on *Euphorbia* near Bologna. On a bug of the genus *Nysius* the spirochaetes measured 14 to 24 by 0·5 μ. *Lygaeus pratensis* and *Anthocoris sylvestris*, found on *Sambucus nigra* in Paris, harboured numerous spirochaetes with no admixture of flagellates. These spirochaetes measured 14 to 20 by 0·33 μ, and were apparently identical in both insects.

Six samples of latex of *Euphorbia peplus* from Syracuse were examined in the summer of 1920. A few flagellates (*Herpetomonas*) were found in one specimen and numerous spirochaetes in two others. The latter resembled the spirochaetes of the bugs described above, except that they were shorter, measuring 6 to 8·5 by 0·5 μ. It is uncertain whether these divergences indicate a separate species or if they are merely the result of a different environment.

The writers have observed that the latex of *Euphorbia* varies greatly as regards the number of bacteria. Sometimes it is almost devoid of bacteria, especially when flagellates are present, while in other cases it contains numerous bacteria of various species and few or no flagellates.

It seems probable from these observations that there is a spirochaetosis of *Euphorbia*, which is propagated, like flagellosis, by certain species of bugs.

FAWCETT (H. S.). **The temperature relations of growth in certain parasitic fungi.**—*Univ. Calif. Publ. in Agric. Sci.*, iv, 8, pp. 183–232, 11 figs., 1921.

Pythiacystis citrophthora, *Phytophthora terrestria*, *Phomopsis citri*, and *Diplodia natalensis*, all obtained from citrus trees, were used. These fungi were grown on corn meal agar, uniformity in the medium being obtained by mixing the entire lot of medium before the start of the experiment. All conditions except the temperature were kept as constant as possible. None of the fungi produced anything but vegetative hyphae during the culture periods.

The cultures of fungi were kept under uniform conditions for nine months or more before the tests of temperature relations were

started. Uniform discs of medium bearing hyphae of the fungi were placed in the centre of Petri dishes containing hardened corn meal agar, and these cultures were kept in incubators at constant temperatures, except for short periods at twenty-four hour intervals when the cultures were removed and measurement made of the diameter of the colonies. The incubators were run at various temperatures from 7·5° to 45° C.

The optimum temperature for the average rate of growth of a fungus on the medium used was found to vary with the length of the period of growth, and with the age of the culture. In general the optimum temperature for growth shifted to a lower temperature with each successive day after the first day. Comparing the growth during the second twenty-four hour period, it was found that the total range of temperature within which growth rate values were one-tenth or more of the maximum rate, included 32·5° to 37° C.; 70 to 80 per cent. of this temperature range is below the optimum temperature.

The author points out that the ten degree temperature coefficient, obtained by dividing the diameter of the colony at any temperature by the diameter of a colony grown at a temperature ten degrees lower, varied with the temperature. This coefficient would be infinity for ranges just below the lowest temperature at which the fungus would grow, would become unity at some range, which would include the optimum temperature of the fungus, and would become zero at points including and reaching above the maximum temperature for growth.

All the fungi used made some growth at 7·5° C. The optimum temperatures during the second twenty-four hour period were as follows: *Pythiacystis citrophthora* 27°; *Phytophthora terrestria* 30°; *Phomopsis citri* 27·5°; *Diplodia natalensis* 27·5°. The maximum temperatures for this period were respectively 32°, 36·5°, 32°, and 36·5°.

MATZ (J.). **La enfermedad de la raíz de la caña de azúcar.** [Root disease of Sugar-cane.]—*Est. Exper. Ins. Porto Rico, Circ.* 56, 12 pp., 1921.

This is a semi-popular account of the causes of root disease of sugar-cane in Porto Rico, with a chapter dealing with methods for its prevention. There are various causes which produce diseased roots, some of them being cultural and others associated with definite organisms. In the former group may be included purely physiological causes, as for instance when the development of the root system is arrested through wet, hard, or unventilated soils, in which the formation of rootlets and root hairs is prevented. These same conditions, however, are favourable to the organisms responsible for root rot and other diseases affecting sugar-cane, such as species of *Pythium* and *Rhizoctonia*, as the increased acidity of the soils described tends to keep down competing bacteria. Root disease is not a specific disease like mosaic, gummosis, or top-rot, for it may be due to more than one organism living in the soil, and be dependent on other factors for its appearance.

The chief symptoms of this disease are the stunted growth of the cane and the poor development of the leaves. Generally the

lower leaves show these symptoms earlier than the more tender leaves higher up, and instead of falling normally when mature they turn yellow and adhere to the stalks. Adhesion of the leaves, base to base, follows. The tender leaves at the top also turn yellow and dry up from the margin towards the centre. This is followed by decay of the internal tissues of the plant, resulting in top-rot.

Another disease, which differs in some respects from the form above described, is due to *Plasmodiophora vascularum* Matz. This organism does not confine itself to the root but travels upwards into the main stem through the tracheids of the fibro-vascular bundles. The production of abundant spores in these channels soon blocks them, with the result that nutritive substances cannot reach the aerial parts of the plant. The progress of the parasite is, however, slow, and the plant may reach its full development before any symptoms are discernible. Nevertheless, in a great number of cases of the disease, plants were found to be so severely affected that at cutting time many of them were only three feet high, and all their top leaves were dead and dry. Only two or three nodes were normal, the rest being shrivelled and of a dead white colour. An examination of these plants revealed the presence of *P. vascularum* in many, if not most, of the fibro-vascular bundles. Where the organism was present the bundles had a bright yellow to orange or sometimes even reddish colour. This latter colour is sometimes produced also by other causes such as lesions inflicted by insects, or rot of the tissues in consequence of gummosis, rind disease, or heart-rot, but in these cases the tissues covering the fibres have a waxy or fatty aspect, thus differing from the disease caused by *P. vascularum*, where the covering layer of tissue retains its transparency, the characteristic coloration being derived entirely from the parasite itself.

This important disease is distributed over nearly the whole of Porto Rico affecting the varieties Cavengerie ('Caña negra'), Rayada, Crystalina, Otaheite ('Caña blanca'), and Demerara 109. Of these the variety Rayada has so far shown the greatest susceptibility, but no data are available regarding the comparative degree of resistance possessed by the other varieties. The disease is not new (though its real nature was only recently discovered), in contrast with mosaic and gummosis which appear to have been introduced recently, as no account of them exists in the older records. It is readily understandable that a disease like that caused by *Plasmodiophora*, the nature of which is not easily appreciated on account of the absence of any striking external symptoms, has in the past been put down to general debility. Though it cannot be regarded as epidemic, the disease must be considered severe because of its general distribution, the susceptibility of the varieties now most frequently grown, and the serious effect on the yield which may be reduced by more than 75 per cent.

In dealing with root disease proper, local conditions must be taken into account and the treatment adapted to suit them. Generally speaking, care must be taken to aerate the soil as much as possible by frequent cultivation, and to secure proper drainage. The chief difficulties are encountered in stump land which easily hardens on the surface, and in sandy soils in which the plant

nutrients are liable to be washed out, thus rendering the development of young roots almost impossible. As the organisms responsible for root disease live in the soil, treatment of the setts with Bordeaux mixture would appear to be superfluous, though it is applied to prevent other diseases. In the case of *Plasmodiophora* the choice of sound setts is of great importance as the parasite can extend into the aerial parts of the plant, and cuttings from affected cane generally carry it, though seed pieces from the top can be used with impunity. Stumps of diseased cane left in the ground transmit the disease to the ratoons, and these constitute veritable foci of infection.

MATZ (J.). **Annual Report for the Division of Plant Pathology and Botany for the year 1920–21.**—*Ann. Rep. Ins. Exp. Sta. Porto Rico*, pp. 51–58, 1921.

In reviewing the work done by the Department, the author points out that many plant diseases in Porto Rico present features which differentiate them from those studied elsewhere under the same name. In sugar-cane, for instance, the Porto Rico gum disease is in all probability entirely distinct from that so fully studied in Java, while the root disease was found to be unlike that usually described in other countries. The *Plasmodiophora* disease of the fibro-vascular bundles of sugar-cane and the *Rhizoctonia* blights and root diseases of many other plants in Porto Rico have not been found elsewhere.

Further investigations into the yellow-stripe [mosaic] disease of sugar-cane brought out the fact that the granular plasma-like substance filling certain parenchyma cells, which constantly occurs in the more or less cankered stalks and leaf sheaths of cane affected with this disease, is also found in the central pithy regions of healthy but over-ripe Yellow Caledonia and G. C. 1313 cane. The mere presence of these plasma-filled cells does not, therefore, necessarily indicate yellow-stripe disease, but the writer believes that the latter, through its deleterious action upon the vital activities of the parenchyma cells, produces an effect analogous to the over-ripening or drying-out of cell sap in such cases as those mentioned, when grown in arid but irrigated fields. Field observations showed that the disease is carried sometimes over considerable distances and that infection may occur through the inner leaves. Whether the disease occurs on maize in Porto Rico is doubtful. So far no trace of it has been found, nor have maize plants growing close to diseased sugar-cane been infected.

The gumming disease of sugar-cane has spread very rapidly and is a menace to the sugar industry in Porto Rico. A detailed study of the relative susceptibility of different cane varieties has been undertaken. So far the variety Otaheite has been found most susceptible. The author states that the bacterium which causes the disease grows slowly or not at all on the more acid media. Inoculation tests showed that susceptible varieties such as Otaheite, B. 376, and Rayada can easily be infected by applying a small mass of bacteria to injured surfaces of growing leaves and tops of cane stalks, that the mature portions of the cane stalks or their roots do not offer likely points of entry to the organism, and that

the disease is not transmitted from plant to plant through the soil. It is believed to be transmitted in the field by direct inoculation with the cutting tools, or by insects or driving rain. Infected ratoons having two or three small infected buds constitute dangerous foci of infection, propagating the disease until the tops of full-grown canes are reached. As the latter do not succumb as easily as the younger shoots, they remain a standing menace to neighbouring healthy fields.

White-root disease and black root-rot of coffee [the latter caused by *Rosellinia* sp.] were found on plantations having large and crowded shade trees and a heavy and moist surface mulch. Under these conditions *Pellicularia* is also frequent. *Stilbella* leaf spot, *Cephalosporium* sp., and *Cercospora* sp. are met with in a greater or lesser degree on coffee plants in nearly all the districts named. Root disease and leaf spot yield to some extent to rational soil treatment, but *Pellicularia* requires spraying and thinning out for its control.

Banana wilt was reported from many districts, and amongst specimens received by the department were *Phyllosticta sacchari* on sugar-cane leaf and *Phytophthora infestans* on tomato. A *Phytophthora* was isolated from the bud of a young coco-nut palm and a *Fusarium* was found constantly present in a root-disease of grape-fruit which has killed several trees in two groves in recent years. This last disease is distinct from the citrus foot-rot, the lesions occurring on the finer roots instead of near the base of the trunk. A serious root disease of onions due to a *Fusarium* was reported, while Avocado roots were attacked by a species of *Diplodia*.

KILLIAN (K.). **Ueber die Ursachen der Spezialisierung bei den Askomyceten. I. Die Monilia cinerea der Kirschen.** [Causes of specialization in the Ascomycetes. I. *Monilia cinerea* of Cherries.]—*Centralbl. für Bakt.*, Ab. 2, liii, 22-24, pp. 560-597, 1921.

The author chose *Monilia cinerea* of cherries for his experiments because of the ease with which it can be cultivated on artificial nutrient media, and also because it is to be found in almost pure culture on the fruit. Besides, there are two distinct forms of this fungus, namely, that of sweet cherries which brings about chiefly the rotting of the fruit and appears therefore to be of a somewhat saprophytic nature, and that of sour cherries which is found as a parasite on the flowers, whence it passes over on to the twigs, although it can also cause the mummification of the fruit in the same way as the other form. Cultivated on different nutrient media, both forms show constant and characteristic differences in the growth and disposition of their mycelium, the *Monilia* of sweet cherries showing its saprophytic tendencies by being less discriminating than the other form in the choice of its food, while the latter perished readily in media not adapted to it. By adding different organic and inorganic salts and acids to the cultures the author sought to bring about a unification of both types of the fungus. He found the *Monilia* of sweet cherries much more amenable to modification than the other. He succeeded, by the

admixture of 3 per cent. of malic acid to a culture on potato-agar, in causing the former to assume all the characteristics of the latter. These characteristics, however, do not seem to become hereditary, as after a few generations, or even in some cases in the next generation, the fungus resumes its specific characteristics when returned to normal conditions. On the other hand, the presence of different organic acids in the nutrient media remained without any appreciable effect on the *Monilia* of sour cherries, which proved to be a very constant type. In one case only, out of a large number of experiments, did the author observe a few cultures of this form (in KNO_3 0·5 per cent., $MgSO_4$ and K_2HPO_4 0·2 per cent., dextrose 2 per cent.) come very near in structure and development to that of sweet cherries.

From these experiments the author comes to the conclusion that the *Monilia* of sweet cherries is a modified form of that of sour cherries, which progressively adapted itself to new conditions of food as the sour cherry tree was gradually being cultivated into the sweet fruit variety, and that the specialization of fungi depends largely on the chemical nature of the substratum on which they live. He seeks confirmation of his hypothesis first in his observation of the fact that the *Monilia* of sweet cherries, if forced to grow on a twig of some sour cherry species, assumes all the characters of the other form and maintains these characters if then transplanted on to sweet fruit-bearing kinds [thus differing from the modifications produced in culture on artificial media described above], and secondly, in the observations of Wormald (1920) on *Monilia cinerea*, Miss A. Hänicke (1916) on *Penicillium* and *Aspergillus*, and especially of Anderson (1912) on *Endothia parasitica* of chestnuts, the latter showing a great analogy with the results obtained by himself. There is an extensive bibliography attached, and the cultural characters of the two strains dealt with are illustrated.

Arnaud (G.). **Sur les affinités des Erysiphées et des Parodiopsidées.** [On the affinities of the Erysipheae and Parodiopsideae.]—*Comptes Rendus Acad. des Sciences*, clxxiii, 25, pp. 1394–1396, 1921.

The author considers that the Parodiopsideae and the Erysipheae form two parallel groups of the same family of the Parodiellinaceae (cf. Arnaud, 'Les Astérinées. II. Études sur les champignons parasites,' *Ann. des Épiphyties*, vii, 1921). The Erysipheae have usually no internal mycelium except their epidermal haustoria, while in the Parodiopsideae there is usually an abundant internal growth.

Perisporina truncata (Stev.) Arn. (*Perisporium truncatum* Stev.) is therefore of interest as showing this parallel development carried to the extent that the internal mycelium is reduced to the same degree as in *Phyllactinia corylea* (Pers.) Karsten amongst the Erysipheae. Its external mycelium produces short branches resembling stigmopodia which, when they pass over a stoma, may form a swelling completely covering both stomatic cells. The fungus then sends through the ostiole a simple, unicellular (rarely septate) hypha which passes through the intercellular spaces directly

towards a cell in the neighbourhood of a vein, where its extremity expands into a bilobed swelling—a kind of appressorium—from which a haustorium is sent into the cell. The haustorium is ovoid, never spiral. In very rare instances two threads may penetrate through the same stoma, but each of them bears only a single haustorium. There are other minor resemblances to the Erysipheae, and the fungus is liable to be parasitized by *Cicinnobella parodiellicola* P. Henn.

DOIDGE (ETHEL M.). **South African Perisporiaceae, VI. The haustoria of the genera Meliola and Irene.**—*Trans. Roy. Soc. S. Africa*, ix, 2, pp. 117–127, 7 figs., 1921.

In corroboration of the work of Maire, the author finds that *Meliola* and *Irene* are true parasites. All the species examined send haustoria into the cells of the host. The penetrating filament is exceedingly fine, but stains well with cotton blue or methyl blue, Sudan III being used as a contrasting cuticular stain and the two stains being combined in lactic acid. The haustoria may develop in the epidermal cells or in palisade or other outermost chlorophyll-containing cells of the mesophyll, and they sometimes pass through one or more sclerenchyma fibres to reach the latter. They are spherical, usually small, thin-walled vesicles not greatly differing in the different species. The character of the penetrating filament is, however, of diagnostic value, and is apparently constant in a given species. The haustoria cause a considerable disorganization of the cells into which they penetrate, and their prejudicial effect may sometimes be seen in the discoloration of the leaf around the infected area; for instance, in *Schinus* purple spots radiate from the point covered by the *Meliola* mycelium, and no other cause has been found for the discoloration. It is not uncommon in South Africa to find the leaves of young seedling trees so covered with the dark mycelium that their normal colour can only be seen when just unfolded.

Similar haustoria were found to occur in *Baladyna velutina* and *Dimerium psilostomatis*.

TANAKA (T.). **New Japanese fungi. Notes and translations. X.**—*Mycologia*, xiii, 6, pp. 323–328, 1921.

Descriptions of a number of new species named by K. Hara in *Chagyôkai* (Tea Journal) in 1918–1919 are translated from the Japanese, and notes are given. All are from tea (*Thea sinensis*) in Japan. The fungi are: *Hypodermopsis theae, Stagonospora theae, Leptosphaeria hottai, Sillia theae, Ascochyta theae, Diatrype theae*, and *Hendersonia theae*. All are parasites except the *Stagonospora* and *Diatrype*, and most have been illustrated by Hara, who has been publishing a series of papers in *Chagyôkai* on diseases of the tea plant, in Japanese.

FAWCETT (G. L.). **Notas preliminares sobre una enfermedad del tabaco.** [A preliminary note on a Tobacco disease.]—*Rev. Indust. y Agric. de Tucuman*, xii, 1–2, pp. 5–17, 14 figs., 1921.

The most destructive disease of tobacco plants, apart from insect troubles, occurring in the Tucumán province (Argentina), is popu-

larly known as 'corcova' (warping or distortion). Its cause has so far not been determined, but the author believes that he has eliminated the possibility of fungous origin, nor has evidence been forthcoming pointing to insect intervention.

The most characteristic symptom is the formation of dark lines on one or both sides of the veins of the leaf, in appearance like the tunnellings of small grubs, but differing from these in that they are more numerous and shorter, being only from 1 to 3 mm. long. Later, the lines situated near the principal veins may unite and form longer markings, or definite spots. On the largest leaves secondary lines, a few mm. distant from the main veins, are sometimes found, the intervening leaf-tissue turning a light or yellowish colour. Affected leaves end by turning yellow and withering. During cool or dry weather the spread of the affection is arrested, the dark lines take on a light colour, and the leaves show no further signs of ill health. On the stems of diseased plants stripes of various forms are frequently found. They generally run longitudinally, measuring 2 to 10 cm. by 1 to 6 mm., and sometimes are at first double. Less frequently small spots or short, bent, or circular stripes are formed, resembling, as in the case of the leaf, the effects of insect attack. The spots, originally yellow, subsequently grow larger, become sunken, and turn black.

Markings in every respect analogous with the black lines on the stem appear also on the principal vein of the leaf. The pith is sometimes affected, the tissues turning black and contracting, and small cavities being formed at regular intervals. Finally it dries up, leaving the stem hollow.

Infection is never uniform. While the healthy parts of the plant continue their growth, that of the diseased portions is arrested, with the result that the upper part of the stem droops and the young leaves are distorted.

The disease attacks plants in all stages of development, from seedlings to fully mature plants, and is favoured by high temperature and abundant moisture. The losses due to it are important in some seasons, almost total failure of the crop having been reported from some plantations.

Wilt caused by *Bacillus solanacearum* Smith has superficially a similar effect, but the slow onset, the absence of any gummy secretion in the vessels, the fact that the leaf veins do not turn black, the scarcity of bacteria in the vascular tissues, and the dry rot instead of a semi-fluid decay of the pith, serve to distinguish the present disease. It has been impossible to reproduce the disease by inoculating with bacteria isolated from diseased plants, or with infusions made from affected leaves (as can be done in the case of tobacco mosaic). Moreover, bacterial infection is almost constantly absent in the first stages of the disease, and the more abundant presence of bacteria in the later stages is probably due to secondary infection. But the possibility of a bacterial origin is not definitely excluded.

Of the control measures tried, neither spraying with Bordeaux mixture or lime sulphur, nor manuring with nitrate of sodium and bone meal, have had the slightest beneficial effect. Pulling up and removing all attacked plants also produced no effect, the disease

spreading just as freely as where no measures were taken. The only means of control that can be suggested at present is the planting of resistant varieties. Of the varieties under cultivation in the province (Habano, Habano de vuelta abajo, Florida Cuban, Habano de Connecticut, Criollo, Florida, Sumatra, Orinoco, Little Orinoco, Zimmer, Yellow Pryor, Pennsylvania Broadleaf, and Turco) only Turco and Criollo have shown a certain resistance. Of the hybrids tried, a cross between Turco and Criollo has given satisfactory results on a small scale. More extensive trials are projected. Other crosses between common tobacco and the wild species *Nicotiana longiflora* Cav. and *N. sylvestris* Speg. & Comes resulted in sterile hybrids. *N. sylvestris*, when cultivated, is very subject to 'corcova', and *N. longiflora* is not completely immune.

SMITH (E. F.) & MCKENNEY (R. E. B.). **A dangerous Tobacco disease appears in the United States.**—*U.S. Dept. of Agric. Circ.* 174, 4 pp., 1921.

A severe outbreak of a mildew, due to a fungus provisionally identified as *Peronospora hyoscyami* de Bary, occurred in tobacco seed-beds in Florida in March 1921. It spread rapidly, and in a month had infected probably all the seed-beds in the cigar-wrapper growing area of Florida and Georgia.

The parasite is stated to have done no damage to tobacco in Europe, where it was first described on *Hyoscyamus niger*, but it has been known for many years as a destructive parasite of seedling tobacco in Australia, where it is called blue-mould. In the United States it has been recorded on a wild tobacco (*Nicotiana glauca*) in California, and specimens of what is apparently the same fungus were received from seedling cultivated tobacco in 1906. The origin of the present outbreak is obscure, several alternative possibilities being discussed.

Immediately on the appearance of this disease, the destruction of the first few severely affected beds was recommended as well as the spraying of other beds not yet, or only slightly, attacked, with Bordeaux mixture. This is believed to have had a good effect. It is further recommended that for the current year the shaded fields in which the expensive wrapper leaf is grown should not be planted unless seedlings known to be healthy are available. A separate publication (Circular 176) has been issued giving these recommendations in greater detail.

COOK (M. T.). **Wilting caused by Walnut trees.**—*Phytopath.*, xi, p. 346, 1921.

Potato and tomato plants within the area of the root system of *Juglans nigra* were frequently found wilted. Investigation showed that the walnut trees were the cause, the areas in which wilting occurred corresponding with the distribution of the root system. Other crops were not found wilted, nor did other trees cause a wilting of crop or wild plants. No explanation of this phenomenon is offered.